From bedrock to alluvium: Considerations on human-lithic resource interaction

Zsolt Mester[1,2], Norbert Faragó[1]

1. Institute of Archaeological Sciences, Eötvös Loránd University, Múzeum krt. 4/B, 1088 Budapest, Hungary.
Email: Z. Mester: mester.zsolt@btk.elte.hu, N. Faragó: farago.norbert@btk.elte.hu
2. UMR 7194 Histoire Naturelle de l'Homme Préhistorique, CNRS/MNHN/UPVD, Institut de Paléontologie humaine, 1 Rue René Panhard, 75013 Paris, France

Abstract:

Although lithic raw material provenience studies in Hungarian archaeology have started in the late 1970s, little attention has been paid to the methods prehistoric people with which acquired these raw materials for tool production. With our palaeoethnological approach, we investigate the relationship between human groups and the world surrounding them, aiming to recognize which environmental factors played a role in their lithic raw material economy and tool production. Prehistoric people weighed a range of such factors against each other when deciding about the utilization of a lithic raw material source. The occurrence-source-archaeological site (OSA) model presented in our article helps to describe the interaction between siliceous rock resources and humans. Any place where stone suitable for knapping can be found is considered to be an occurrence. If the lithic raw material from an occurrence is found in the archaeological material, we call it a source, as it was utilized by humans. All places where remains of human activity are found are usually considered archaeological sites. Siliceous rock occurrences are considered raw material sources with a long history prior to human interaction, travelling from the original bedrock to alluvial deposits, due to the geologic-geomorphologic processes of formation, transformation, and transport. The characteristics, of these occurrences, including location, determine not only the distance of transportation but also the quality and condition of the blocks available. Based on these assumptions our research has two aims: to locate lithic raw material occurrences available for prehistoric people and to recognize their decisions about extraction. For the first one, we mapped occurrences of several siliceous rocks in the region. To reconstruct lithic raw material utilization and preferences, we conducted a techno-economic analysis. We studied two areas and their characteristic lithic raw materials in northern Hungary: limnosilicite from the foothills of the Mátra mountain range (Mátraalja), and Buda hornstone or chert from the Buda Hills.

The utilization of both materials is documented at archaeological sites of several prehistoric periods. Both rocks occur in the study areas at several locations that can be considered prehistoric extraction sites. According to Turq's source area typology, allochthonous sources are not present, but primary and secondary autochthonous as well as sub-allochthonous types have been identified in both areas. However, the exploitation of primary autochthonous limnosilicites could not be demonstrated in the Mátraalja. At the moment, the exploitation of secondary autochthonous and sub-allochthonous sources can be hypothesized for all concerned prehistoric periods.

Journal of Lithic Studies (2022) vol. 9, nr. 1, 44 p. DOI: https://doi.org/10.2218/jls.7475

Published by the School of History, Classics and Archaeology, University of Edinburgh
ISSN: 2055-0472. URL: http://journals.ed.ac.uk/lithicstudies/

Keywords: siliceous rock occurrences; lithic raw material sources; OSA model of interaction; Palaeolithic; Neolithic; northern Hungary

1. Introduction

Mineralogical identification of stone tools has been published since the very beginning of Hungarian Palaeolithic research; moreover, the geological occurrence of the given rock type was also indicated in some cases (Dienes 1968; Kadić 1916: 231-235; Vendl 1940). However, except for some special siliceous rocks (*e.g.*, Vértes & Tóth 1963), lithic raw material sourcing started only in the late 1970s, including excavations of prehistoric quarries (Bácskay 1981; 1995; Biró 1984; 1995; Biró & Pálosi 1985; Gábori-Csánk 1988; Simán 1995a; 1995b). Following the international conference on flint mining and lithic raw material identification, held in Budapest and Sümeg in 1986 (Biró 1986; 1987), a large comparative raw material collection (*Lithotheca*) was established in the Hungarian National Museum in Budapest, aiding provenience studies at archaeological sites (Biró & Dobosi 1991; Biró *et al.* 2000). The past decades witnessed intensive fieldwork and the enrichment of *lithothecas* with a large amount of data produced by different chemical and physical methods (Biró 2004).

However, little attention has been paid to the anthropological point of view: how prehistoric people acquired the raw materials for their stone tool production. K. T. Biró's overview (2004) contains generalized statements on this topic, encompassing the long period from the Early Palaeolithic to the Middle Neolithic. These generalizations originated partly in summarized conclusions of international publications, and partly from her studies of Neolithic sites and lithic assemblages. Although numerous well-established examples were already published abroad (*e.g.*, Andrefsky 1994; Féblot-Augustins 1990; 1997; 2009a; Geneste 1988; 1989; Loodts 1998; Perlès 1990), detailed lithic technological analyses to understand past human behaviour in raw material procurement and processing strategies have been missing in Hungarian prehistoric archaeology until the middle of the 2000s. Hungarian scholars usually interpreted lithic economy based on calculations of the distances between archaeological occurrences and geological sources (Biró 2004; 2009; Dobosi 1997; 2009; Markó 2009; Simán 1991a; 1991b). However, the peculiar raw material composition at the Andornaktálya site needed a more complex, technology-based analysis (Kozłowski & Mester 2003; Mester 2009; Mester & Kozłowski 2014). Our study of this assemblage convinced us that for the reconstruction of prehistoric raw material economies we must shift from the "provenience approach" to the "palaeoethnological approach" (Mester *et al.* 2012: 282). The first approach focuses on the geological source and its distance from the human settlement. To calculate the distance, this approach generally compares raw materials found at archaeological sites to provenanced specimens in already existing databases and *lithothecas*. The second approach investigates the knapping activity at a given archaeological site. To understand technical behaviour, including procurement strategy, it is necessary to know the petrographic conditions and raw material accessibility in a given region (Turq 2000: 98-141; 2005). During our field surveys at various siliceous rock outcrops, supported by the International Visegrad Fund in 2011-2012, we observed interesting situations which motivated us to launch a research program aiming at studying raw material sources with a complex approach (Mester 2013; Mester & Faragó 2013; Mester *et al.* 2012).

2. Theoretical considerations and methodology

The theoretical and methodological background for our research program is inspired by the French school of lithic technology engaged with the investigation of human behaviour since the 1950s (Audouze 1999; Audouze & Karlin 2017; Perlès 2016; Texier & Meignen 2012). The main aim of this scientific approach is to better understand prehistoric people, their goals and motives, through the evidence of their activities in the social context (Tixier 2012: 69-132). All these activities form the technical system of the human group or society, of which raw material procurement and stone tool production are components (Geneste 1988; 1991; Lemonnier 1983; 1986; Mester 2019).

2.1. Occurrence *versus* raw material source

The palaeoethnological approach in lithic studies is concerned with the lifeways of prehistoric groups, in a similar manner as anthropologists observe contemporaneous societies. Therefore, we are interested in their relationship to their surrounding world. In other words, we investigate which elements of their natural environment had played a role in their life strategies as resources, including lithic raw material economy and tool production.

From an anthropological point of view, the prehistoric acquisition and use of raw materials are influenced by a range of factors. Without being exhaustive, these are 1) availability and accessibility of outcrops, 2) exploitability of the sources, 3) appropriateness of the raw material.

1) The availability means that siliceous rock outcrops or other forms of potential lithic raw material sources are present in the territory the human group inhabits. Based on ethnological analyses, the territory is the culturally determined organization of the physical space as well as the representation of the symbolic space within which the complex relations of the known world are being managed (Bracco 2001; Howey & O'Shea 2006). In our actual scope, the territory of a prehistoric group means the physical space which provides all resources necessary for their survival (in a wider sense). For hunter-gatherer groups, the size of the territory depends on the distribution of natural resources and the exploitation strategy of the group (Binford 1980; 2002: 109-143). The geologic and geographic properties of the region determine resource density, especially lithic raw material occurrences. Hunter-gatherers directly exploit their territory while foraging, as has been demonstrated in Upper Palaeolithic (Djindjian 2009; 2012) and ethnoarchaeological contexts (Beyries 1997; Binford 2002: 109-143). In contrast, a farming community needs complementary natural resources beyond their limited habitation and cultivation area, to secure the resources missing from there. From our point of view, this area constitutes the virtual territory of a farming community, virtual in terms of being independent of the landscape regularly cultivated and inhabited by the community (Mester & Rácz 2010: 24; Mester *et al.* 2012: 278). Analyses of lithic assemblages from Neolithic sites in the lowland areas of the Pannonian basin (Great Hungarian Plain) demonstrated the use of lithic raw materials of the surrounding mountainous areas (Biró 1998a; Faragó 2016; Szakmány *et al.* 2011).

The accessibility of lithic outcrops is a complex problem. On the one hand, there are environmental factors that can temporarily or periodically cover or even uncover the outcrops (ice, snow, water, vegetation). In a longer time frame, erosional processes form the landscape, rendering outcrops available or unavailable (*e.g.*, Pereira & Benedetti 2013). On the other hand, human factors might have determined accessibility. Hunter-gatherer land-use strategies, including mobility patterns in relation to the organization of different tasks (Binford 1979; Turq 1996) or seasonality (Richter 2006), can result in overlooking available raw material sources in the foraging territory. Regarding the accessibility of distant sources, annual or seasonal long-distance migrations (Binford 1982; Lengyel 2018), as well as regular intergroup contacts (Mester & Kozłowski 2014) presented opportunities for access. At least from the Upper Palaeolithic onward, exchange networks had been established between communities (Allard & Denis 2021; Féblot-Augustins 1999; Gamble 1999: 268-416; Whallon 2006). In the

Neolithic, a steady supply system became an important avenue for accessibility to raw materials or even products (Lech 2003).

2) The exploitability of an occurrence depends on technical, economic, and organizational factors. According to the physical properties of the occurrence (with its geologic and geomorphologic context), the acquisition of siliceous rock needs the application of different techniques, from simple collecting on the surface to mining (Fober & Weisgerber 1981). These techniques require distinct toolkits and know-how at the disposal of the community. Opening quarry pits and other techniques for raw material extraction are documented from the Palaeolithic era already (Barkai *et al.* 2002; Kozlowski 1991; Petraglia *et al.* 1999; Vermeersch 2005). Flint mines requiring more complex technical and social investments are known from the Neolithic period onward (Weisgerber *et al.* 1981: 32-213). Considering the distance between the locations of the source and use, procurement also could pose logistical and organizational problems. For optimal exploitation, the spatial aspect of the raw material economy must have been organized (Bonjean & Otte 2004; Geneste 1988; 1989; Miller 1997; Otte *et al.* 2001; Stout 2002). Moreover, the available or expected quantity of the siliceous rock at an outcrop must have been played a crucial role in the decision about exploitation.

3) The appropriateness of raw materials is a multifaceted issue. To decide whether a siliceous rock type is useful for tool making is in strict relation to the real-life situation. When a prehistoric knapper decided to make a tool for any purpose, it is necessary to choose the corresponding tool idea and the related technical knowledge to apply. However, the manufacture of the artefact had been constrained by the environment (*e.g.*, quality and quantity of the available raw material), tradition (*e.g.*, customs, accepted or prohibited solutions), and the body of the knapper (*e.g.*, personal skills and knowledge) (Inizan *et al.* 1999: 15; Mester 2019: 259; Tixier 1980; 2012: 40-41). The magnitude of these constraints also depends on the real-life situation: is it vital to solve the problem or not so much. On the level of the technical system of the group, all types of rocks are considered appropriate raw materials which suit the technical behaviour related to tool production.

All these factors were weighted by prehistoric knappers to decide about occurrences as being a potential raw material source or not. The decision might not seem to be logical from an economic point of view (according to our modern understanding), but it must have been logical from a social or cultural point of view (according to their understanding) (Király *et al.* 2020; Mester & Tixier 2013; Perlès 2009).

2.2. Raw material sources and modes of acquisition

Siliceous raw material sources occur in many forms in the landscape, carrying their particular histories before human exploitation, from the original bedrock in which they were formed, to the alluvial deposits (Delvigne *et al.* 2019: 94-96, fig. 2). Each occurrence represents a stage of this rock biography resulting from geologic-geomorphologic processes of formation, transformation, and transport. Four types of raw material sources can be distinguished by the phases of a general sequence of transformation (Turq 2000: 106-107; 2005). The first source type applies to the raw material embedded in the parent rock in the original context of the formation (primary autochthonous source). The second type is a source where the raw material is already moved by erosion and accumulated in the vicinity of the original primary autochthonous source but still in contact with the eroded material of the parent rock, in a slope deposit or a stream bed (secondary autochthonous source). The third type is located in a weathered rock or colluvium in a new geological context due to transformation and re-deposition by erosion (sub-allochthonous source). The fourth type is sources consisting of eroded and accumulated raw material that had been transported long distances by water courses or ice sheets and deposited with fluvial or glaciofluvial sediments (allochthonous source).

For the interpretation of the lithic assemblage at an archaeological site, distinguishing between these types of origin is very important. The type of source affects not only the distance of transportation but also the quality of the extracted blocks. Effects of weathering may deteriorate a material of originally good quality in the secondary autochthonous or sub-allochthonous source, while an originally medium-quality material can become better in the allochthonous source because its more homogenous parts had been sorted out during the transport by water or ice sheets.

These source types provide different conditions for getting raw material blocks. At a primary autochthonous source (and eventually, at a sub-allochthonous source), the acquisition certainly needs special extracting techniques. According to the hardness of the embedding rock it requires lower or higher energy investment, but it results in a probably considerable quantity of acquired raw material. At a secondary autochthonous source (and eventually, at a sub-allochthonous source), both simple collecting and extracting can be applied. If the blocks are situated on the surface or slightly embedded in the loose sediment, they are easy to get. The more embedded blocks may require more digging, but even in this case, the extraction requires less energy as at a primary autochthonous source. Taking into account the accumulation of the eroded material, a secondary autochthonous source probably yields a higher number of blocks as well. At an allochthonous source, raw material acquisition is similar to the former one: simple collecting on the surface or eventually, digging. However, according to our own field experience, it should consume a considerable amount of time to get a limited number of blocks because the fluvial or glaciofluvial deposits contain all types of rocks occurring within the reach of the transporting agent.

2.3. Methods

Based on these assumptions our research has two aims: to reconstruct the locations of lithic resources available for prehistoric people who lived in a region in a given period and to recognize people's decisions about their utilization with their behavioural background.

To reach the first objective, the task is to make a comprehensive inventory of siliceous rock occurrences in the region. The basic methodology is widely known and employed: field prospection and sampling of the geological formations which potentially contain siliceous rocks according to geological maps (*e.g.*, Féblot-Augustins 2009b: 170-171; Turq 2000: 33-35). Observations during archaeological surveys about the presence of blocks of siliceous rock round out the picture. On these occasions, it proved to be useful to check places marked on the map by geographical names containing elements like cherty or flinty. Several times these names indicated the presence of scattered raw material blocks (potential sub-allochthonous source). Within the abovementioned framework of rock biography and landscape history, a GIS database has been created with the registered occurrences, the geomorphologic and pedologic characteristics of the region (Dövényi 2010) and the geological map of the Mining and Geological Survey of Hungary (Gyalog 2005). Analyses of these overlapping spatial data resulted in locations to check in the field to identify further potential raw material occurrences in the studied region.

Each occurrence is characterized according to source type and sampled for siliceous rock diversity. The samples are stored in the reference collection at the Institute of Archaeological Sciences of the Eötvös Loránd University in Budapest (ELTE), established in 2011 (Mester *et al.* 2012). The basic petrographic characterization of the samples is usually conducted at a macroscopic and a microscopic level (water immersion) (*e.g.*, Brandl 2014: 39-40; Féblot-Augustins 2009b: 167-168; Přichystal 2013: 43-45; Turq 2000: 35-36). Thin section examination and geochemical analyses (*e.g.*, Brandl 2014: 40) are in progress or planned for the future.

To reconstruct the decisions and raw material use by prehistoric people, a techno-economic analysis is applied (Geneste 1988; Loodts 1998; Turq 2000: 39-43), based on the technical reading methodology (Inizan *et al.* 1999: 89-100; Tixier 2012: 115-132). The key concept behind this reconstruction is the notion of operational chain or *chaîne opératoire* (Audouze & Karlin 2017; Karlin *et al.* 1991; Mester 2019; Pelegrin *et al.* 1988; Sellet 1993). The identification of the utilized raw materials was done with the help of the ELTE reference collection, together with the source type. In the case of archaeological material without identified raw material sources, the type of the source is difficult to recognize. However, utilized raw material blocks have their autobiography recorded in the microstructure of the rock. A new analytical approach, based on taphonomical and petroarchaeological observations at different scales, allows decoding the various stigmata on the surface and in the crystallization of stone artefacts originating from complex physicochemical and mechanical phenomena during post-genetic processes (Fernandes & Raynal 2006; 2010; Fernandes *et al.* 2007).

2.4. A model for human-lithic resource interaction

As it was stated above, the palaeoethnological approach aims at reconstructing people living in the past through their activities. As a consequence, when we are talking about raw material procurement or economy, it is a matter of interaction between humans and the natural lithic resources. Following the above-listed factors (section 2.1.), which are all prone to change with time, this interaction has a certain dynamism. The palaeoethnological approach must manage this dynamism. For this purpose, we constructed a model which serves as a theoretical framework, a descriptive tool, and terminology (Table 1).

Table 1. Aspects of the human-lithic resource interaction.
Table 1. Les aspects de l'interaction humain-resource lithique.

lithic resource	occurrence	source	archaeological site
interaction	non-existing	indirect	direct
human activity	no	use	exploitation
archaeological evidence	nothing	presence in lithic assemblage	local or nearby traces

From the perspective of human activity, the human-lithic resource interaction can be: direct, indirect, or non-existing. This third category is also important because the absence is meaningful for reconstructing human behaviour and decisions: people had hardly any contact with the lithic source, though it existed at the time and context concerned. It is equivalent to the term of negative evidence (*témoin négatif*) introduced by A. Leroi-Gourhan to palaeoethnographic analysis at the Magdalenian site of Pincevent in France (Leroi-Gourhan & Brézillon 1972: 323). It has to be analyzed and demonstrated whether a decision (economic, technical, cultural, or any other) or a certain condition (unknown resource, not frequented place, or any other) or a combination of those explains the situation. Direct interaction means that human activity had been present more or less regularly at the lithic source. Conversely, indirect interaction is manifested in the proof of contact between the lithic resource and humans without traces of this contact at the raw material source. Regarding human activity, direct interaction is indicated by visible traces of extraction or treatment of the siliceous rock at its source, while indirect interaction is testified by the utilization of the siliceous rock as raw material, but without traces of extraction or treatment at the source. Examples for the latter are long-distance raw material accessed through intergroup contact or raw material blocks collected from the ground without on-site testing. Of course, collecting is a human activity at the source in this latter case but without any trace left behind, it cannot be documented. Archaeologically, direct interaction is evidenced in features and objects (*e.g.*, extraction pit, mining tool, workshop material, knapping waste heap) at or nearby the raw material source. Indirect interaction, *i.e.*, the use of a given siliceous rock is proven by its presence in any form (*e.g.*, raw material block or fragment, core, blank, retouched tool, waste) in the lithic assemblages from archaeological sites. Based on these differences in human-lithic resource interaction, the raw material sources should also be classified into three categories (Table 1): source without interaction is only an occurrence because humans did not utilize it as a raw material (confer in section 2.1.); raw material source with indirect interaction is a source because people used it but we are lacking traces of extraction or treatment on-site, and finally the source with direct interaction is an archaeological site due to direct traces of local human activity. The relationship between these three categories of lithic source locations is clear (Figure 1): certain occurrences are sources and certain sources are archaeological sites as well, while the rest of the archaeological sites are not sources. An archaeological site might be located next to a lithic raw material source but if the people did not exploit it, this resource remained an occurrence.

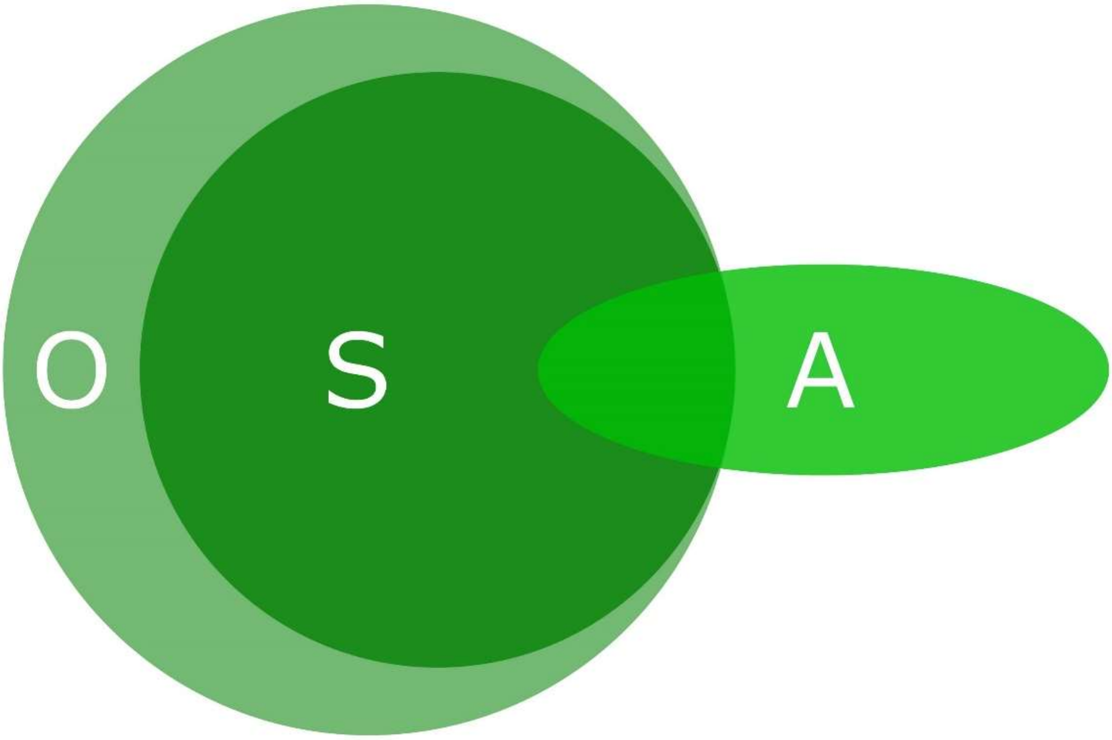

Figure 1. The occurrence-source-archaeological site (OSA) model. Occurrence (O): available siliceous rock resource without human utilization; Source (S): an occurrence of a siliceous rock used by humans, but without traces of human activity at the site; Archaeological site (A): locality with human activity related to raw material acquisition or use. (CAD by N. Faragó).
Figure 1. Le modèle gîte-source-site archéologique (OSA). Gîte (O): resource de roche siliceuse qui est disponible mais inutilisée par les humains; Source (S): gîte d’une roche siliceuse utilisé par les humains mais sans activités sur place; Site archéologique (A): localité avec activité humaine liée à l’acquisition ou l’utilisation de matières premières. (DAO: N. Faragó)

The usefulness of the occurrence-source-archaeological site (OSA) model became evident when we applied it to the abovementioned dynamism. Each locality in the study of human-lithic resource interaction can be attributed to one of the three categories according to its status in the studied period. When this status had been modified, the attribution of the locality (*i.e.*, its place in the model) also changed immediately. For example, when a new human group arrives in a region - such as modern humans in the Early Upper Palaeolithic (Mellars 2011) or the first farmers during the Neolithisation of the Carpathian Basin (Kozłowski 2004) - they do not possess knowledge about local raw material sources. All available and accessible siliceous rocks are occurrences to these people until they discover the region and start to use some of them. The occurrences of the utilized rocks become sources to the human group, or even archaeological sites if they establish workshops or extraction sites. As the discovery of the region advances, the group continues to use the already known raw materials but they may no longer be able to acquire some of them directly. However, the occurrences of these raw materials remain sources. After the group successfully adapted its raw material economy to newly discovered sources and leave the former ones, the previous sources become occurrences in the OSA model. The model functions in the same way independent of the scale of the study. According to the scope of the analysis, different types of changes or the role of different changing factors can be described with the help of the model. For example, the role of cultural-technological changes along the stratigraphic sequence of an archaeological site (Féblot-Augustins 2009c; Mester 2004a; Perlès 2004; 2013), the role of changes in climate, environment, and subsistence strategies in a greater geographic region and over a longer period (Lengyel 2018). The model also allows studying the dynamism in the spatial organization of the raw material economy of a cultural unit during a period, as well as the pattern of exploitation of the sources in a region by contemporaneous communities (Oliva 2009). Finally, our scientific knowledge about a respective region, cultural entity, or period also changes over time, along with the research, which has its dynamism.

3. Study areas and materials

In 2017, we started two new investigations; one project was due to a research grant from the National Research, Development and Innovation Fund, and the other had been a scientific collaboration with the Budapest History Museum - Acquincum Museum. These allowed us to advance in two small regions with different geological backgrounds and different raw materials which were used from the Palaeolithic to the Bronze Age.

The first study area is the Mátraalja and Bükkalja regions, being the southern foothills of the Mátra and Bükk mountains respectively, and the second one is the Buda Hills, being the western part of Budapest, capital of Hungary. In this paper, we discuss the Mátraalja region and compare the results from there to those obtained from the southern part of the Buda Hills (Faragó *et al*. 2018) (Figure 2). Our conclusions are discussed using the OSA model.

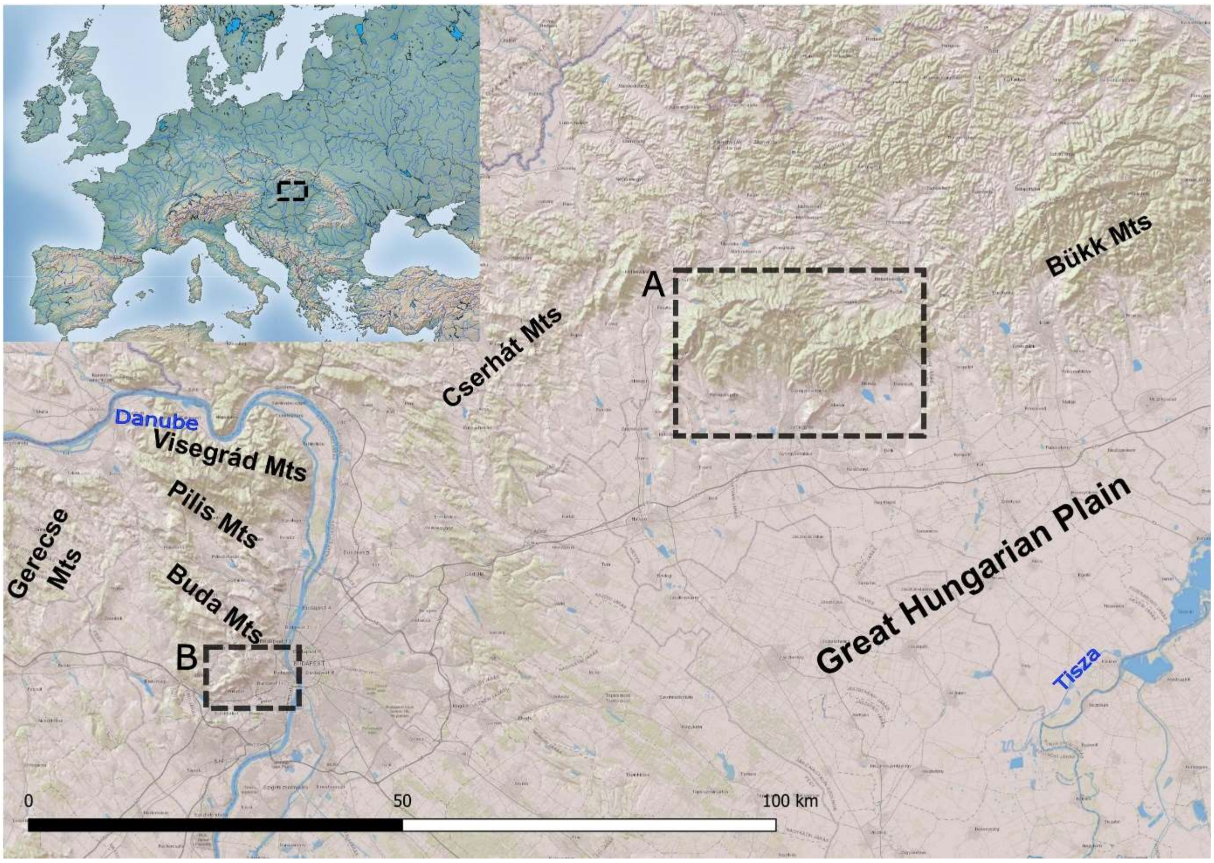

Figure 2. Location of the study areas in Northern Hungary. A: Mátra Mountains; B: southern part of the Buda Hills. (CAD by N. Faragó)

Figure 2. Localisation des aires étudiés en Hongrie du nord. A: montagne de Mátra; B: partie méridionale des monts de Buda. (DAO: N. Faragó)

3.1. Mátraalja region

The Mátraalja geographic region is located at the southern foothills of the Mátra Mountains in Northern Hungary, extending over about 450 km^2 between the valleys of the rivers Zagyva (to the west) and Tarna (to the east), tributaries of the river Tisza (Baráz & Kiss 2010; Dövényi 2010: 723-729) (Figure 3). The Mátra Mountains constitute a part of the North Hungarian Range which belongs to the Inner Western Carpathians. It has a complicated tertiary volcanic structure and history which took place in the area of the Middle Parathetys (Pelikán 2010; Zelenka 2010), in the framework of the Neogene to Quaternary volcanism of the Carpathian-Pannonian Region, in strong connection to the geodynamic evolution of the area (Harangi 2001; Harangi & Lenkey 2007; Harangi & Lukács 2019; Seghedi *et al.* 2005). In the western part of the mountains, andesite and rhyolitic tuff can be found which were formed during the Carpathian and Badenian stages of the Early and Middle Miocene (from Burdigalian to Seravallian) on the border of the sea. In collapsed craters, in connection with post-volcanic activity, thick diatomaceous earth had been deposited in a limnobrackish basin near Szurdokpüspöki and Gyöngyöspata villages (Szurdokpüspöki Formation). This diatomite layer complex can be subdivided into an upper part (yellowish-white) and a lower part (greyish). The diatomite layers alternate with limnoopalite layers, generally having a very varied and vivid colour. The middle-southern part of the mountains has a similar genetic history, where mainly pyroxene andesite with rhyolite intrusions from the Lower Badenian (Langhian) can be found. The hydrothermal activity resulted in a large body of supplementary andesitic rocks with jasper, chalcedony and quartzites with different colour variants from white, bluish-white to lilac and red, and geyser cones and terraces in the vicinity of

Gyöngyöspata, Gyöngyöstarján, Gyöngyösoroszi, and Gyöngyössolymos villages (Gyöngyöspata Limnoquartzite Member of the Szurdokpüspöki Formation). The southern edge of this foothill region is covered by colluvial clay sediments mostly from the Pannonian (from Tortonian to Piacenzian). Descending southwards, to the Great Hungarian Plain, Pleistocene slope sediments dominate the landscape.

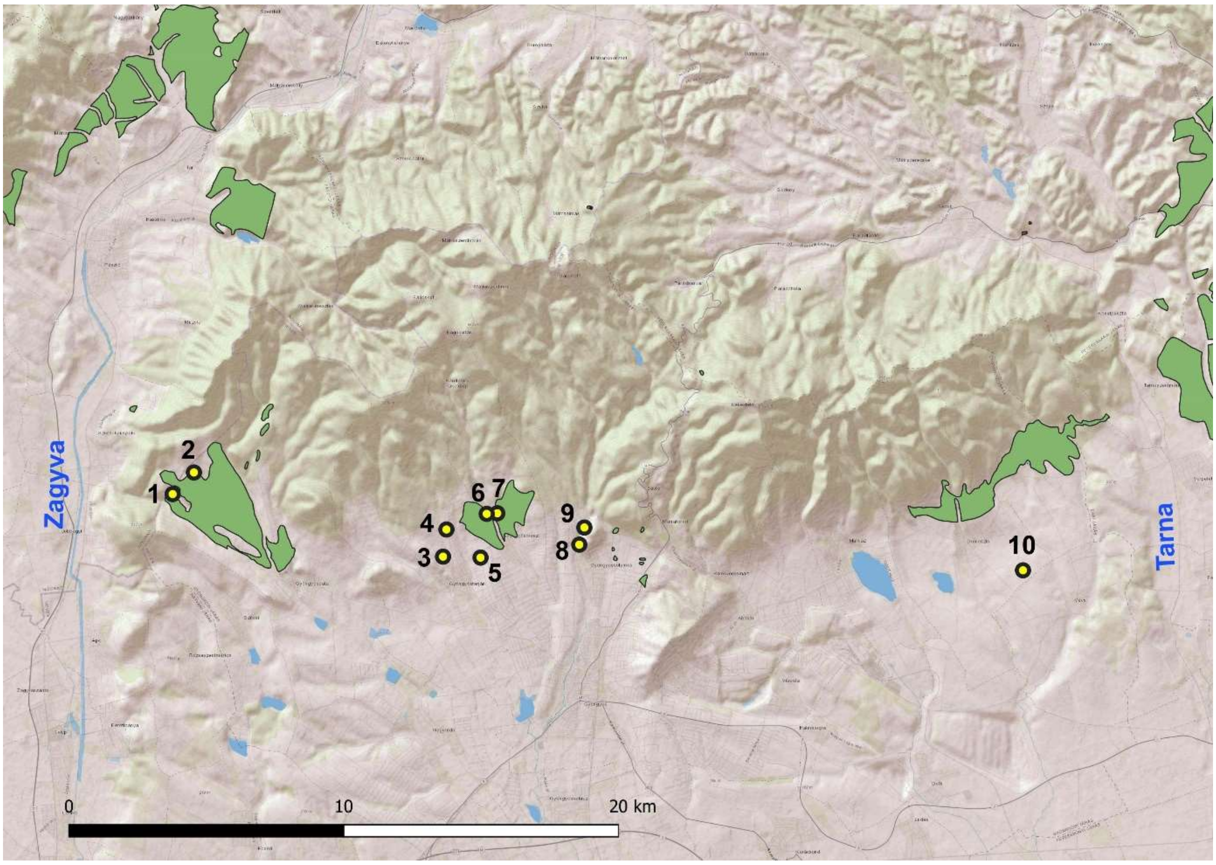

Figure 3. Map of the Mátra Mountains with the geological formations containing siliceous rocks (green patches), according to the geological map of the Mining and Geological Survey of Hungary (https://map.mbfsz.gov.hu/fdt100/), and the occurrences (yellow circles) already registered into the database of the Institute of Archaeological Sciences of Eötvös Loránd University, Budapest. 1: Szurdokpüspöki-Diatoma-bánya; 2: Gyögyöspata-Tilalmas-tető; 3: Gyöngyöstarján-Füledugó-bánya; 4: Gyöngyöstarján-Köves-tető; 5: Gyöngyöstarján-Tűzköves-dűlő; 6: Gyöngyösoroszi-Bánya-domb; 7: Gyöngyösoroszi-Dögkút; 8: Gyöngyössolymos-Lilakő-bánya; 9: Gyöngyössolymos-Cserkő-bánya; 10: Domoszló-Vécsi-part. (CAD by N. Faragó)

Figure 3. Carte de la montagne de Mátra avec les formations géologiques contenant de roches siliceuses (tâches vertes), d'après la carte géologique du Service de Minerie et de Géologie de la Hongrie (https://map.mbfsz.gov.hu/fdt100/), et avec les gîtes (cercles jaunes) déjà enregistrées dans la base de données de l'Institut des Sciences archéologiques de l'Université Eötvös Loránd à Budapest. 1: Szurdokpüspöki-Diatoma-bánya; 2: Gyögyöspata-Tilalmas-tető; 3: Gyöngyöstarján-Füledugó-bánya; 4: Gyöngyöstarján-Köves-tető; 5: Gyöngyöstarján-Tűzköves-dűlő; 6: Gyöngyösoroszi-Bánya-domb; 7: Gyöngyösoroszi-Dögkút; 8: Gyöngyössolymos-Lilakő-bánya; 9: Gyöngyössolymos-Cserkő-bánya; 10: Domoszló-Vécsi-part. (DAO: N. Faragó)

This Tertiary post-volcanic silicification formed a group of potential raw materials, the main characteristic of which is great petrographic variability. These rocks were identified as quartzites, chalcedonies, chalcedony opals, *etc.*, according to their observable characteristics in thin sections, igniting a never-ending terminological debate (Biró 2010). Following A. Přichystal (2010; 2013: 48-50), this group of siliceous rocks is named limnosilicites (limnic silicites). Within the group, Přichystal distinguishes geyserite formed by thermal springs activity and limnic silicite originating in freshwater limnic (lake) environments. Although this distinction is important from a geologic-petrographic point of view, we use the term of limnosilicite for both types of rocks because most of the time, the conditions of formation of raw materials recovered in archaeological context are not known (Mester & Faragó 2016).

3.2. Southern part of the Buda Hills

The western part of Budapest is a hilly landscape on the right side of the river Danube, named Buda Hills, which represents the north-eastern end of the Transdanubian Range (western Hungary) (Figure 4). Together with the Alps, the Dinarides, and the Western Carpathians, the Transdanubian Range belongs to the ALCAPA Mega-unit which broke off of the African Plate and was formed by the Alpine orogeny during the Late Mesozoic and Cenozoic (Budai 2009; Haas 2012: 1-102). The Buda Hills are built up of dolomite and limestone, formed on the Tethyan shelf in the course of the Triassic (Budai & Maros 2016; Wein 1977: 10-23). Due to tectonic movements, the shallow marine platforms broke up during the Carnian, calcareous and siliceous mud was deposited between the blocks. From these sediments were formed the cherty limestone and the cherty dolomite (Mátyáshegy Limestone Member and Sashegy Dolomite Member of the Mátyáshegy Formation in the northern and southern parts of the area respectively). New palaeontological data suggest that some parts of the cherty dolomite in the southern zone could be dated to the Early and Middle Norian (Karádi *et al.* 2016). In the Late Eocene, a transgression reached the area, where breccia and conglomerate were formed from the dolomite of the rocky cliffed coasts due to strong wave action (Budai & Maros 2016; Wein 1977: 24-29). Chert nodules can be found also in the blocks of Upper Eocene breccia-conglomerates. During the Badenian of the Middle Miocene (Langhian and Seravallian), the sea invaded the surroundings of the Buda Hills which stood out like an island. In the Pliocene, parallel to the filling up of the Lake Pannon, the uplift of the Buda Hills took place. This process resulted in the development of the present morphology. The increased relief energy caused the increase of the linear erosion and the formation of the present valley system of the area. Debris was transported from the inner parts of the mountains to the Danube bed and its alluvial plain. The foothill stretching out to the south is covered by Pleistocene slope sediments and loess-like sediments.

The existence of the Upper Triassic chert in the Buda Hills was demonstrated by geologists in the first half of the last century (Károly 1936). The geological occurrences of the cherty dolomite contain grey or brownish-grey chert nodules and lenses, distributed parallel to the layers of the dolomite. This rock is named “Buda hornstone” in the archaeological literature (Biró 1998a: 32; Biró 2002a; Biró & Dobosi 1991: 123, 136-137; Faragó *et al.* 2018).

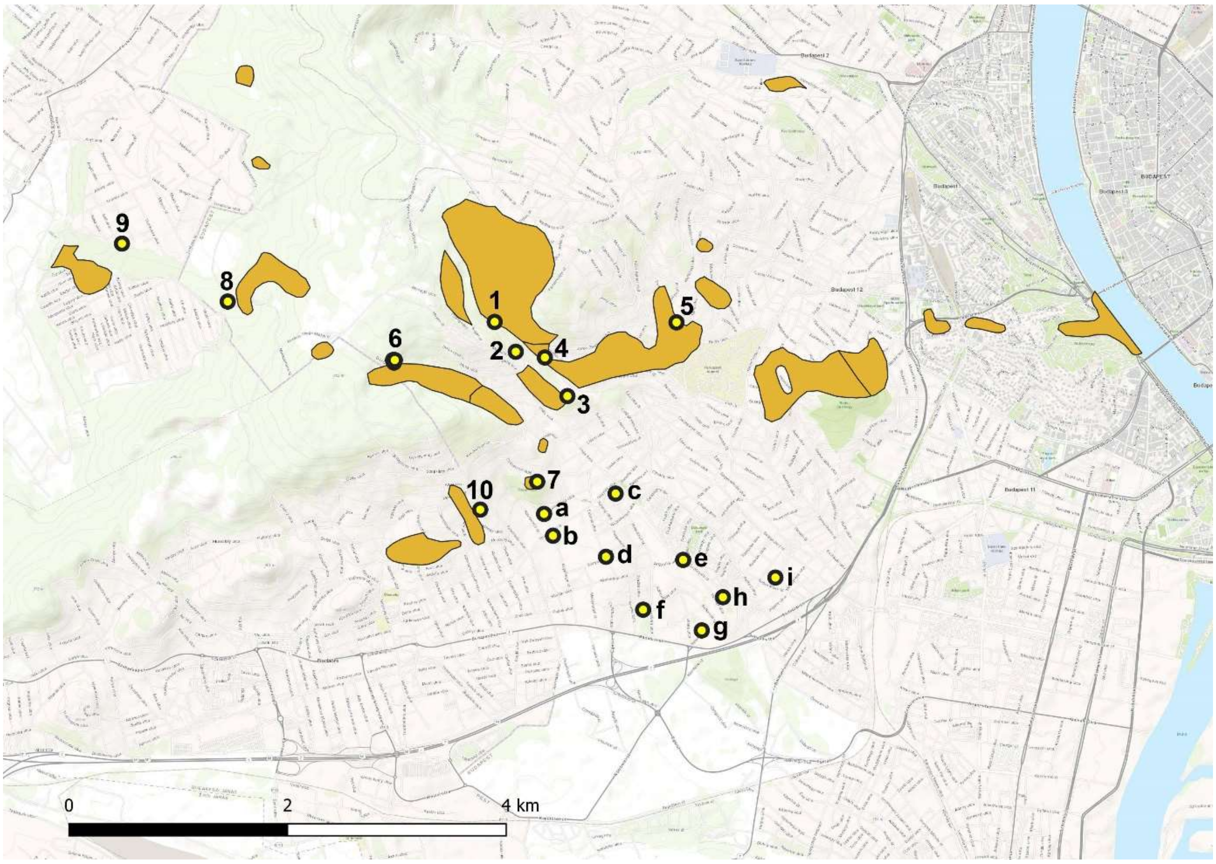

Figure 4. Map of the southern part of the Buda Hills with the geological formations containing Buda hornstone (orange patches), according to the geological map of the Mining and Geological Survey of Hungary (https://map.mbfsz.gov.hu/fdt100/), and the occurrences (yellow circles) already registered into the database of the Institute of Archaeological Sciences of Eötvös Loránd University, Budapest. 1: Farkas-völgy 1; 2: Farkas-völgy 2; 3: Ördög-orom; 4: Edvi Illés utca; 5: Budapest-Farkasrét; 6: Irhás-árok; 7: Rupp-hegy; 8: Végvári-szikla; 9: Budakeszi-Kavics-árok; 10: Budaörs-Tűzkő-hegy; a-i: occurrences recorded during archaeological supervision. (CAD by N. Faragó)

Figure 4. Carte de la partie méridionale des monts de Buda avec les formations géologiques contenant de roches siliceuses (tâches oranges), d'après la carte géologique du Service de Minerie et de Géologie de la Hongrie (https://map.mbfsz.gov.hu/fdt100/), et avec les gîtes (cercles jaunes) déjà enregistrés dans la base de données de l'Institut des Sciences archéologiques de l'Université Eötvös Loránd à Budapest. 1: Farkas-völgy 1; 2: Farkas-völgy 2; 3: Ördög-orom; 4: Edvi Illés utca; 5: Budapest-Farkasrét; 6: Irhás-árok; 7: Rupp-hegy; 8: Végvári-szikla; 9: Budakeszi-Kavics-árok; 10: Budaörs-Tűzkő-hegy; a-i: lieux d'apparition documentés durant supervision archéologique. (DAO: N. Faragó)

4. Results

Concerning the two aims, the research program is in progress. In this paper, we report the state of art with a focus on the problem of the raw material sources and their possible acquisition. For the characterization of the occurrences from the palaeoethnological viewpoint, the application of Turq's categories of the types of sources proved to be fruitful.

4.1. Possible sources of the Mátraalja

Limnosilicites of the Szurdokpüspöki Formation have a fine microcrystalline structure. Detailed petrographic characterization of the samples of this raw material collected on the field has yet to be conducted. Macroscopically, they are of varied colours, from whitish-yellow to dark green and brown (Figure 5: B). Very often the colour is vivid which is probably linked to the accompanying metal ore deposits of the same volcanism (Zelenka 2010). Some varieties have stripped or mottled patterns according to the silicified sediments.

There are translucent variants too. Biró & Dobosi (1991: 20-32) attributed their samples, coming from the localities of the same area to limnic quartzite, limnoopalite, geyserite, or jasper. According to Varga *et al.* (1975: 218-227, 441), the rocks originating from geysers consist of chalcedony-opal beds, coloured, often banded, and celled, which contain various quantities of tuff debris admixed to the siliceous material (traces of nearby volcanic eruptions) or non-identifiable plant remains (lake environment).

The quality of the limnosilicite varies from considerably bad to excellent according to its composition and structure. Some variants are very homogenous and translucent similar to flint, difficult to distinguish macroscopically in archaeological material. Other variants contain inclusions, inhomogeneities, cracks, being almost unfit for knapping. Even in the case of inferior variants, techno-economic considerations about future use, great quantity and easy accessibility of the raw material could result in an intensive procurement. The considerable proportion of block fragments, abandoned cores, unused blanks, and waste in a lithic assemblage permits the assessment of such a situation.

In the field, limnosilicites occur in layers of different thicknesses, from 5 to 30 cm. Their sequences probably form big bodies of siliceous rocks. At several spots along the border of the mountains, these bodies crop out in hilltop positions, covered by only a thin soil layer. On the Köves-tető hill (2 km to the north of Gyöngyöstarján) a small modern quarry has opened the limnosilicite body. In this case, we cannot date archaeologically the debris of human activity. In contrast, at a similar occurrence on the Bánya-domb hill (1.5 km to the northwest of Gyöngyösoroszi, Figure 5: A) we observed pieces wearing negatives of removals among the huge amount of natural fragments and debris (Figure 6). Until now, we did not find traces of prehistoric human extracting activity. Similarly, on the Tilalmas-tető hill (3 km to the east of Szurdokpüspöki), where the surface of an orchard is covered by limnosilicite blocks and debris due to agricultural work, we collected flakes and fragments of raw material blocks showing clear traces of knapping. These artefacts could be attributed to Prehistoric times. It is interesting that in the valley of the Száraz-patak stream, just below the hill at a distance of hundred meters from the former occurrence, we could not find any traces of human activity, however, the layers of the same limnosilicite have been uncovered by the cutting in of the valley.

Another type of occurrence was observed at Tűzköves-dűlő ("Cherty field") in the eastern fringes of Gyöngyöstarján, where limnosilicite blocks, as well as jasper and volcanic blocks, were scattered in a vineyard brought to the surface by agriculture. No human impact has been detected on the blocks. This field is located at 250 m a.s.l. at a distance of 2 km to the south of the top of the mentioned Bánya-domb hill (330 m a.s.l.), and considered to be a long slope of the hill.

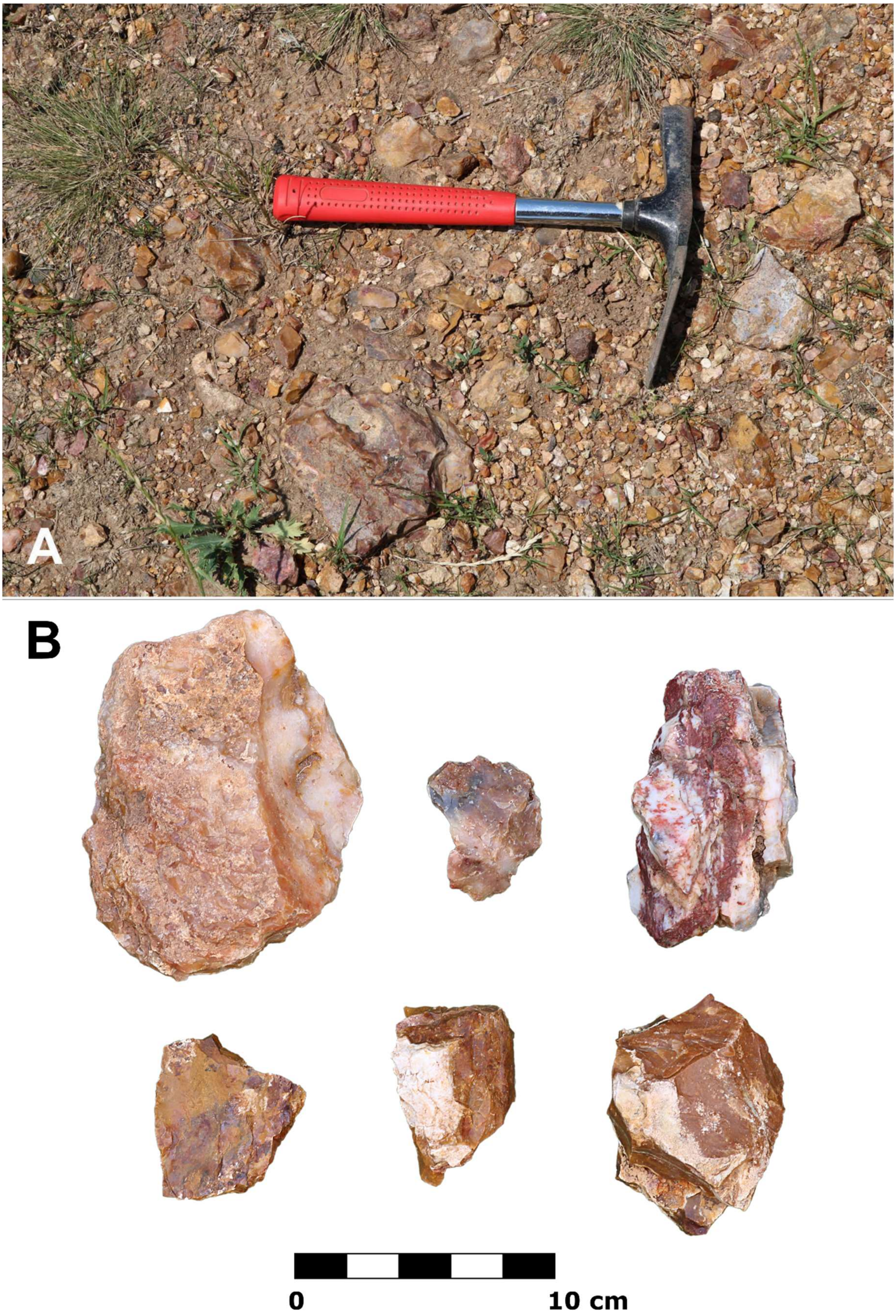

Figure 5. Limnosilicite of the Mátra Mountains from the Bánya-domb hill. A: outcrop on the top of the hill; B: raw material blocks. (Photo and CAD by Z. Mester and N. Faragó)

Figure 5. Limnosilicite de la montagne de Mátra provenant de Bánya-domb. A: l'affleurement au sommet de la colline; B: blocs de matière première. (Cliché et DAO: Zs. Mester et N. Faragó)

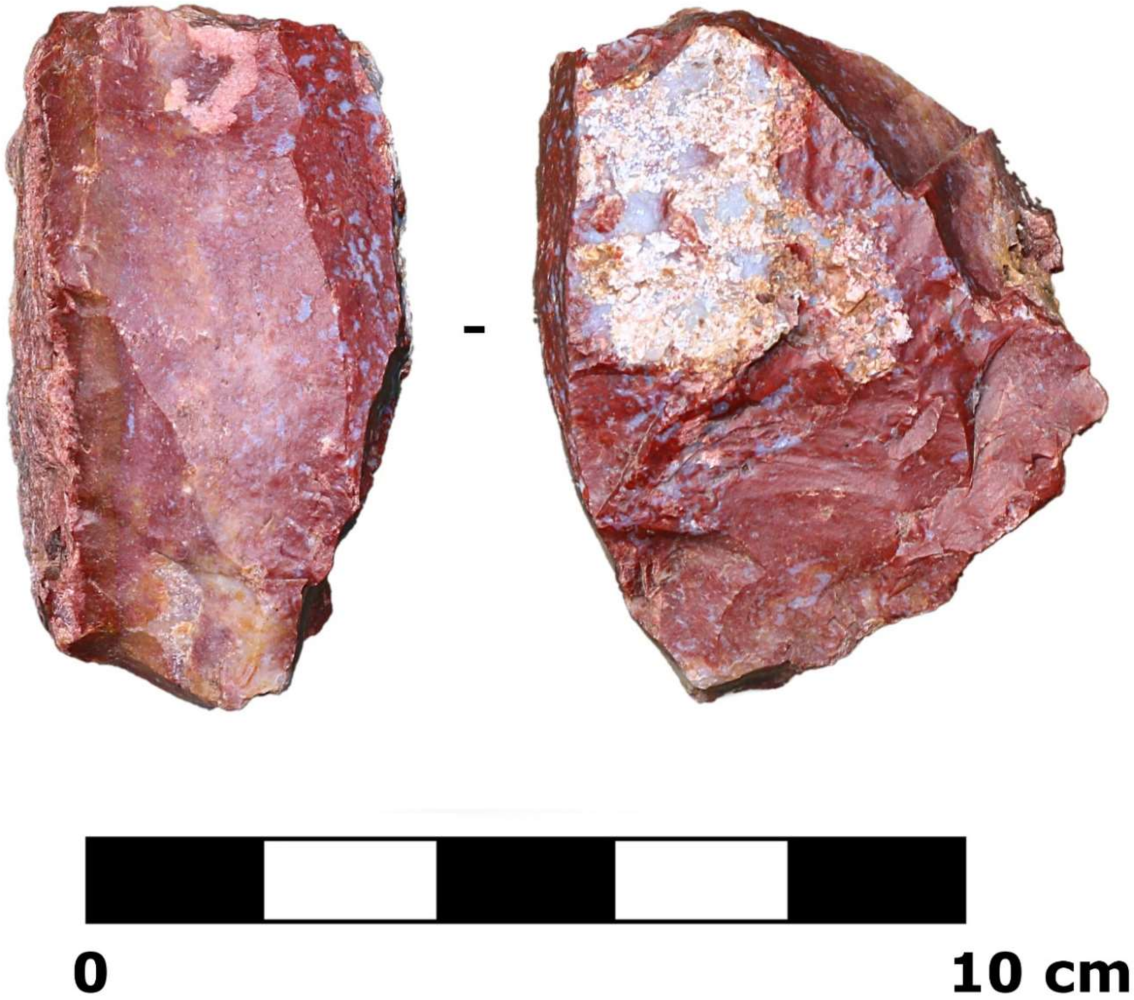

Figure 6. Blade core of limnosilicite from Bánya-domb hill. (Photo and CAD by N. Faragó)
Figure 6. Nucléus laminaire en limnosilicite provenant de Bánya-domb. (Cliché et DAO N. Faragó)

At the Mátraalja, limnosilicites formed in great bodies of siliceous rocks according to the geological map. Practically, there is no parent rock as in the case of chert or flint nodules in Jurassic or Cretaceous limestone. For this reason and in this sense, there is no possible primary autochthonous source according to Turq's category. However, the outcrops of these bodies in hilltop positions, as we reported, should be classified as such. Streams or derasion processes cut valleys in the rock bodies, hence the limnosilicite beds became accessible. In both cases (*i.e.*, on the hilltop and in the valley), the raw material has to be extracted by quarrying methods. However, it is very difficult to cut blocks from the rock body even with modern tools, as we have experienced at an outcrop of the Carpathian radiolarite in Streženice, western Slovakia (Mester & Faragó 2013: fig. 6). Another possible way to extract blocks is the use of fire-setting for quarrying purposes in volcanic raw material contexts (Stout 2002: 697). Prehistoric use of this extraction method for limnosilicite has been hypothesized at the Avas Hill raw material source in Miskolc, at the eastern fringe of the Bükk Mountains (northeast Hungary) (Tóth 2016). In the Mátraalja, we did not find archaeological evidence of this extraction method, although viticulture could cover its traces. However, quarrying is not necessarily confined to limnosilicite blocks on eroded hilltops. During the Pleistocene, frost splitting also resulted in the fragmentation of the rock surface. Geomorphological field observations in the Mátraalja as well as the related sedimentological and micromorphological analyses proved the presence of permafrost in the glacial periods of the Pleistocene (Horváth *et al.* 2002; Michéli & Mindszenty 2002). Because the raw material blocks were already disturbed by erosion, this situation corresponds rather to a secondary autochthonous source according to Turq's categories. The third kind of source is represented by scattered limnosilicite blocks in the landscape, as it was documented at Gyöngyöstarján. According to our field prospection, the quasi-overall presence of raw material blocks in foothill areas is also observed at the Bükk Mountains' piedmont zone. This is due to the formation of planation surfaces along the North Hungarian Range as a result of the continuous uplift of the mountainous area parallel to the subsidence of the basin (Great Hungarian Plain) (Karátson 2006; Pinczés *et al.* 1993). These occurrences are considered sub-allochthonous sources in Turq's categorization.

The prehistoric use of these limnosilicites is reported from archaeological sites in the region in Middle Palaeolithic, Upper Palaeolithic, and Neolithic contexts (Table 2, Figure 7). These raw materials occur in other regions too: in the neighbouring Cserhát and Bükk mountains and even in the Great Hungarian Plain, also from Middle Palaeolithic, Upper Palaeolithic, Mesolithic and Neolithic contexts (Table 2; Figure 7). Taking into account their mobility, hunter-gatherer groups of the Palaeolithic and Mesolithic probably exploited the secondary autochthonous and sub-allochthonous limnosilicite sources. Related to certain activities, Neolithic people could also profit from these sources. We do not know any traces of prehistoric limnosilicite quarrying in the area. The freestanding, naturally fragmented blocks at the hilltops were probably easily accessible for prehistoric people. The presence of flakes and core remnants already testified to knapping activity at these sources.

Table 2. Occurrences of Mátra limnosilicites and Buda hornstone at archaeological sites (see Figure 7). BA: Bronze Age; CA: Copper Age; EBA: Early Bronze Age; EN: Early Neolithic; EUP: Early Upper Palaeolithic; LCA: Late Copper Age; LMP: Late Middle Palaeolithic; LN: Late Neolithic; LUP: Late Upper Palaeolithic; MBA: Middle Bronze Age; Mes: Mesolithic; MN: Middle Neolithic; MP: Middle Palaeolithic.

Table 2. Présence des limnosilicites de Mátra et celle de la chaille de Buda aux sites archéologiques (voir Fig. 7). BA: Âge du Bronze; CA: Chalcolithique; EBA: Âge ancien du Bronze; EN: Néolithique ancien; EUP: Paléolithique supérieur ancien; LCA: Chalcolithique récent; LMP: Paléolithique moyen récent; LN: Néolithique récent; LUP: Paléolithique supérieur récent; MBA: Âge moyen du Bronze; Mes: Mésolithique; MN: Néolithique moyen; MP: Paléolithique moyen.

No.	**Archaeological site**	**Age**	**Reference**
1	Alattyán-Vízköz	LN	Biró 1998a
2	Andornaktálya-Zúgó	EUP	Kozłowski & Mester 2003
2	Andornaktálya-Gyilkos	EUP	Zandler 2012; Mester *et al.* 2021
3	Apc	MN	Kaczanowska *et al.* 2016
4	Aszód-Papi földek	LN	Biró 1998a
5	Bia-Öreghegy	MBA	Balogh 1998; Horváth 2012
6	Bölcske-Vörösgyír	EBA, MBA	Horváth *et al.* 2000a
7	Budakalász	LCA, EBA	Balogh 2009; Horváth 2017
8	Budapest-Albertfalva	CA, EBA	Biró 2002a
8	Budapest-BEAC	MBA	Horváth 2012
9	Budapest-Aranyhegyi út	EN, MN	Biró 1998a
10	Budapest-Csepel, II. Rákóczi Ferenc utca	EBA	Biró 2002a
11	Budapest-Hollandi utca	EBA	Biró 1991
11	Budapest-Medve utca	LCA	Biró 1998b
12	Budapest-Káposztásmegyer	LCA	Biró 1998b
13	Budapest-Péteri major	MBA	Horváth 2012
13	(Budapest-)Soroksár-Várhegy	MBA	Horváth 2012
14	Buják-Szente	EUP	Péntek & Zandler 2014

No.	Archaeological site	Age	Reference
15	Csesztve-Stalák	LN	Biró 1998a
16	Csongrád-Vidre	MBA	Horváth 2012
17	Demjén-Pünkösdhegy	EUP	Zandler 2012
18	Dunaújváros-Kosziderpadlás	MBA	Horváth 2012
19	Eger-Kőporos	MP, EUP	Zandler 2012
20	Egerszalók-Kővágó	MP, EUP	Kozłowski *et al*. 2009
21	Endrőd 39	EN	Starnini & Szakmány 1998
22	Érd(-Parkváros)	MP	Mester 2004b
23	Feldebrő-Bakoldal 1	LUP	Gutay *et al*. 2016
24	Füzesabony-Gubakút	MN	Biró 2002b
25	Gyöngyöstarján	MP	Gutay *et al*. 2010
26	Halmajugra-Szoller-dűlő	LUP	Gutay 2016
27	Hódmezővásárhely-Gorzsa	LN	Starnini *et al*. 2007
28	Hont-Csitár	EUP	Zandler 2010
29	Igar-Vámpuszta-Galástya	MBA	Horváth 2012
30	Jászberény 1	Mes	Kertész *et al*. 1994
31	Jászfelsőszentgyörgy	LUP	Dobosi 2001
32	Jásztelek 1	Mes	Kertész *et al*. 1994
33	Kakucs-Balladomb	MBA	Horváth 2012
34	Legénd-Hosszú-földek	EUP	Péntek 2018
34	Legénd-Káldy tanya	MP	Markó & Péntek 2003
35	Lovasberény-Mihályvár	MBA	Horváth 2012
36	Mende-Leányvár	MBA	Horváth 2012
37	Mezőkövesd-Mocsolyás	MN	Biró 2002b
38	Nagykőrös-Földvár	MBA	Horváth 2012
39	Nagyréde	EUP	Lengyel *et al*. 2006
40	Ostoros-Rácpa 1	MP, EUP	Zandler 2012
41	Öcsöd-Kováshalom	LN	Biró 1998a; Kaczanowska *et al*. 2009
42	Pákozd-Vár	MBA	Horváth 2012
43	Páty-Nagyhegy	MBA	Horváth 2012
44	Polgár-Csőszhalom	LN	Faragó 2016
45	Solymár-Mátyásdomb	MBA	Horváth 2012
46	Százhalombatta-Sánchegy or Százhalombatta-Földvár	EBA, MBA	Horváth 2005; Horváth *et al*. 2000b; Pető *et al*. 2002
47	Szécsénke-Berecz-oldal	EUP	Péntek 2015
48	Szécsény-Ültetés	MN	Biró 1998a
49	Szegvár-Tűzköves	LN	Biró 1998a
50	Szigetszentmiklós-Felső Ürge-hegyi dűlő	EBA	Péntek & Zandler 2017
50	Szigetszentmiklós-Üdülősor	EBA	Balogh 1992
51	Szolnok-Tűzköves	LN	Biró 1998a
52	Tiszaszőlős-Domaháza-puszta	EN	Domboróczki *et al*. 2010
53	Tószeg	MBA	Balogh 1998; 2001
54	Túrkeve-Terehalom	MBA	Balogh 2001; Horváth 2012

No.	Archaeological site	Age	Reference
55	Vanyarc	LMP, EUP	Péntek & Zandler 2018
56	Verőcemaros-Magyarkút	LN	Biró 1998a

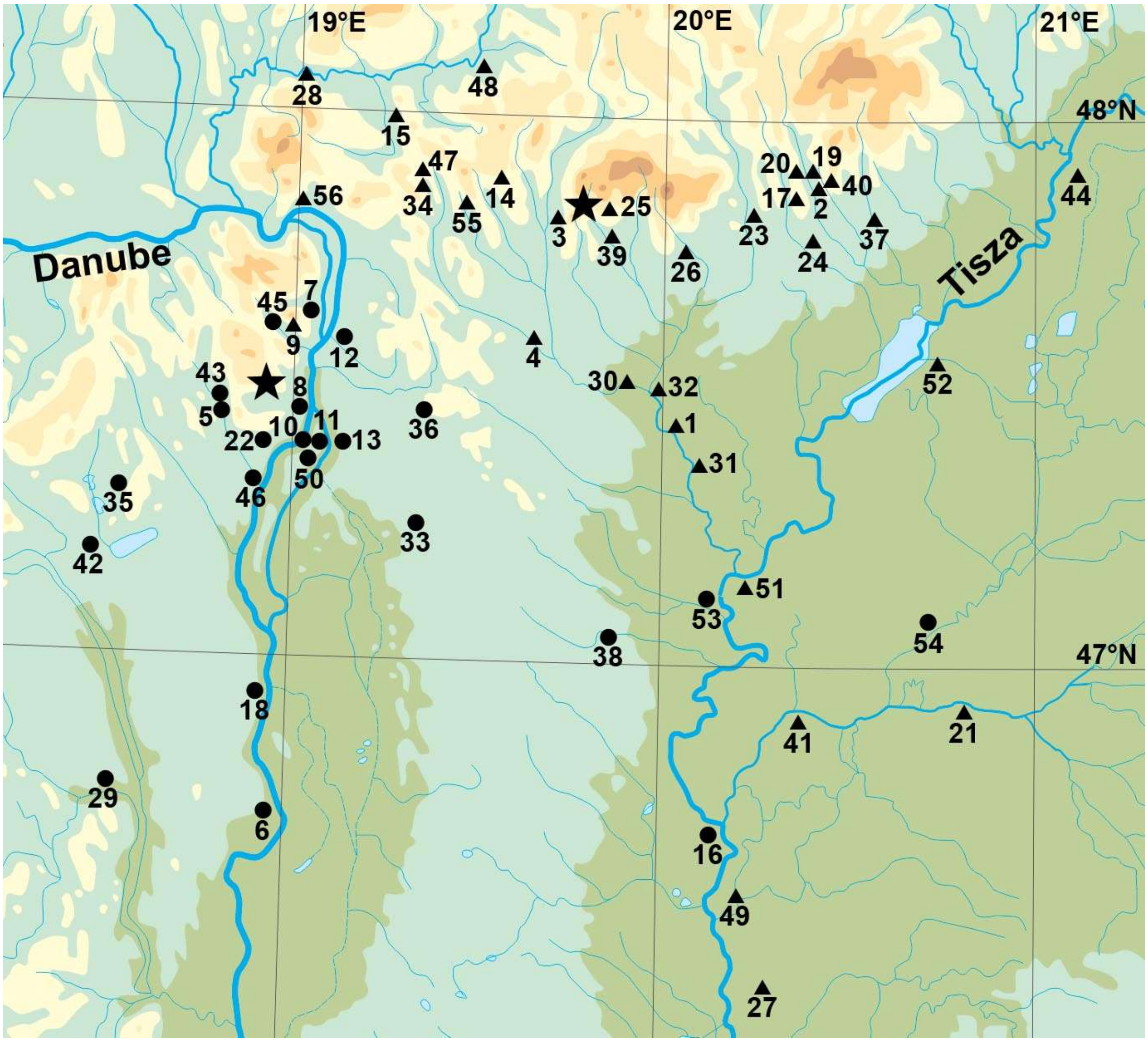

Figure 7. Distribution of the limnosilicites of the Mátra Mountains (triangles) and the Buda hornstone (circles) at archaeological sites in Hungary. For sites see Table 2. (CAD by Z. Mester)

Figure 7. Distribution de limnosilicites de la montagne de Mátra (triangles) et celle de la chaille de Buda (cercles) aux sites archéologiques en Hongrie. Pour les sites voir Table 2. (DAO: Zs. Mester)

4.2. Possible sources in the southern part of the Buda Hills

The siliceous rocks embedded into the “cherty dolomite” had been studied for the first time by E. Károly (1936). She described it as *szarukő* which is the Hungarian name for “hornstone.” That is why this raw material is known as the “Buda hornstone” in the Hungarian archaeological literature (Biró 1998a: 32; Biró 2002a; Biró & Dobosi 1991: 123, 136-137; Faragó *et al.* 2018; Horváth 2017). A. Přichystal (2013: 128) named it “Triassic Buda chert”, and characterized as a very light grey to bluish-grey siliceous material, containing small lenses of chalcedony, hair-like thin cracks, and milky clouded parts, which is not a high-quality raw material because of the cracks inside (Figure 8: B). In her petrographic study of the samples collected during our field surveys, R. K. Péter demonstrated that colour variants display differences in thin sections as well (Faragó *et al.* 2018: 179-181).

Figure 8. Buda hornstone of the Buda Hills from Farkas-völgy 1. A: knapped flakes and fragments of a hammerstone in a supposed pit; B: tested nodules. (Photo and CAD by Z. Mester and N. Faragó)

Figure 8. Chaille de Buda des monts de Buda provenant de Farkas-völgy 1. A: éclats taillés et fragment de percuteur dans une fosse d'extraction supposé; B: rognons testés. (Cliché et DAO: Zs. Mester et N. Faragó)

The use of Buda hornstone by prehistoric people was firstly proven by the fortuitous discovery of several antler mining tools at the Denevér street site next to the Farkasrét cemetery (Biró 2002a: 131; Vörös 1998-1999: 69). Between 1984 and 1987, systematic archaeological excavations were carried out at the extraction site named Budapest-Farkasrét (Gábori-Csánk 1988; Faragó *et al.* 2018) (Figure 9). Based on archaeological considerations, V. Gábori-Csánk (1988) argued for a Middle Palaeolithic time-frame, although the extracted rock type was not known from archaeological contexts at that time. After the excavations in the 1980s, Buda hornstone outcrops were visited in the course of raw material surveys (Biró 2002a: 131) and sampled for the *Lithotheca* of the Hungarian National Museum (Biró & Dobosi 1991: 123, 136-137). Due to new systematic field prospections from 2013 onward, F. Cserpák localized ten occurrences in the study area (Faragó *et al.* 2018) (Figure 4: 1-10). At Rupp-hegy hill and Tűzkő-hegy hill, the chert nodules are exposed on the surface in the dolomite. At the other localities, they were found in slope sediments (Figure 8: A). The dolomite embedding the chert nodules is highly pulverized in the Farkas-völgy valley and at the Budapest-Farkasrét site, broken and friable at the Ördög-orom hill, and bedded at the Végvári-szikla locality and the Kavics-árok valley. At the Ördög-orom hill and Budapest-Farkasrét site, the siliceous nodules can be found heavily cemented in breccia-conglomerate.

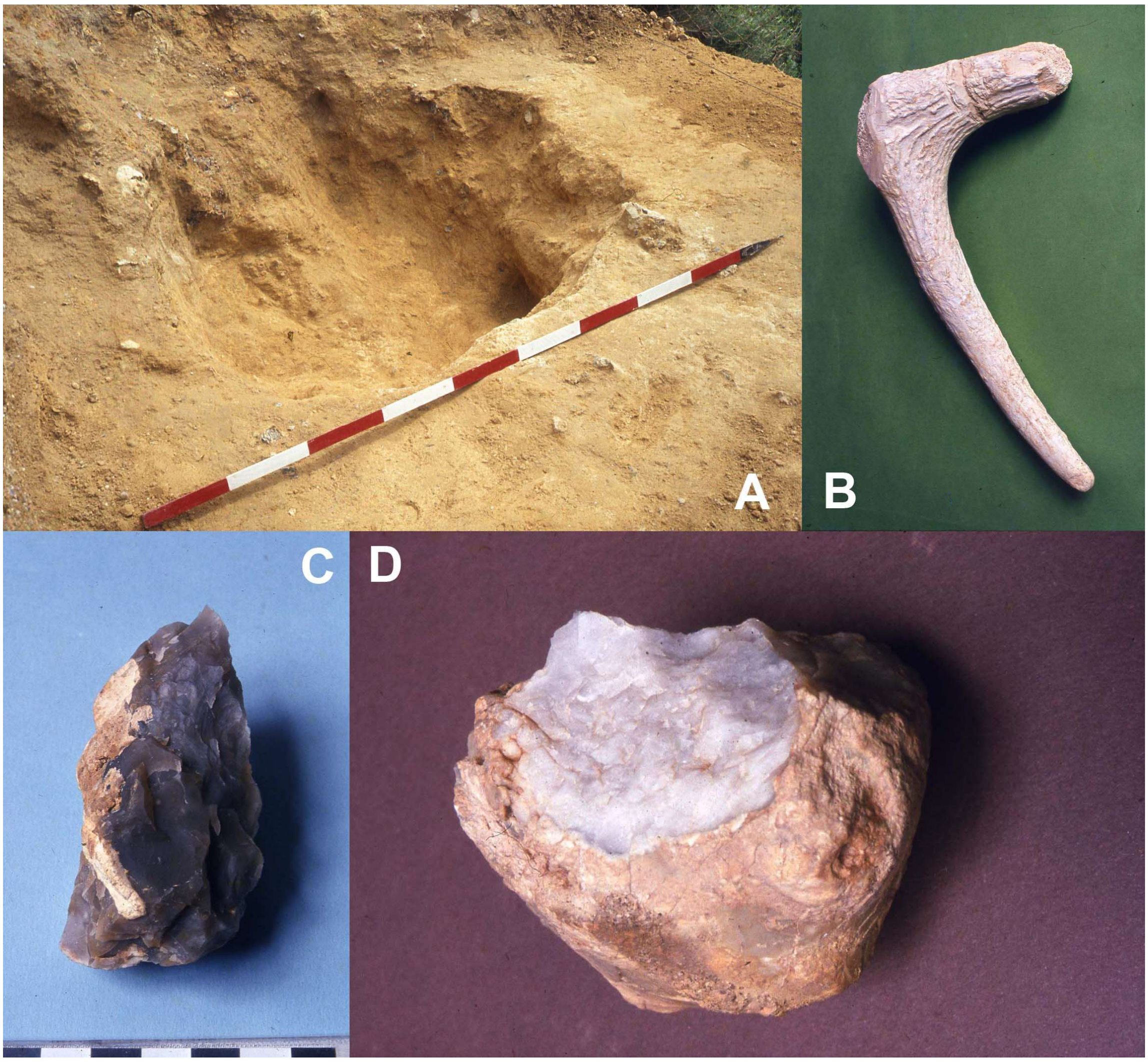

Figure 9. Budapest-Farkasrét site. A: extraction pit; B: antler tool; C: side-scraper; D: tested nodule. (Photo by M. Gábori, CAD by Z. Mester)

Fig. 9. Site de Budapest-Farkasrét. A: fosse d'extraction; B: outil en bois de cerf; C: racloir; D: rognon testé. Cliché: M. Gábori, DAO: Z. Mester)

Up to now, besides the Budapest-Farkasrét site, the occurrences in the Farkas-völgy and Irhás-árok valleys have yielded artefacts of prehistoric human activity. In most cases, the collected assemblage comprises core remnants and flakes without any ceramics (Figure 10). Furthermore, hammerstones are also abundant. According to our field prospection at these localities, the surface morphology suggests the existence of extraction features. There is a series of small, mainly shallow depressions which are common in prehistoric quarrying fields in Europe (Budziszewski *et al*. 2019; Sudoł-Procyk *et al*. 2018). This requires further investigation, however, after cleaning the surface we found knapping debris inside these features (Figure 8: A).

Figure 10. Knapped flakes and fragments of hammerstone from Farkas-völgy 1. (Photo and CAD by N. Faragó)
Fig. 10. Éclats taillés et fragments de percuteur provenant de Farkas-völgy 1. (Cliché et DAO: N. Faragó)

The outcrops are located at 250 - 300 m a.s.l. In the last few years, archaeological supervision has been conducted during house constructions in the Spanyolrét, Madárhegy, Hosszúrét, Gazdagrét and Sasad quarters of Budapest, lying to the south of the foothills between 130 and 195 m a.s.l. In the eastern part of this area, D. Kraus reported nine localities where large quantities of bigger boulders (the size of a fist or child-head) and nodule fragments have been unearthed from the clayey and loess sediments under the Holocene soil (Faragó *et al.* 2018) (Figure 4: a-i).

In the studied area of the Buda Hills, primary autochthonous sources were identified at the Ördög-orom hill and at the Végvári-szikla locality where chert blocks can be seen in the wall of the dolomite cliffs. However, there is no evidence of human extraction. We found features similar to the mentioned pit-like depressions in their vicinity which seem to be more plausible sources, but of the secondary autochthonous type. Interestingly, these locations fit quite well to the borders of the patches of the "cherty dolomite" formation of the geological map (Figure 4). The actual vegetation cover hinders the discovery of the locations where erosion already uncovered chert blocks. Among the nine identified occurrences, the only exception is the Budapest-Farkasrét extraction site. There is grassy vegetation probably because of the very thin soil layer.

Nevertheless, the periods of use of the Buda hornstone suggested by the archaeological evidence at our disposal (Table 2) probably have had less favourable climatic conditions for forests, thus possibly better visibility of the occurrences. The Middle Palaeolithic human occupation of Érd took place under a cold climate and in a mainly open environment with patches of coniferous forest. We only can hypothesize these circumstances without any modern sedimentological analyses and mainly based on the presence of large herbivores like woolly rhinoceros and horses and the identified charcoals from the hearths (Daschek & Mester 2020). The period from the Late Copper Age Baden Culture to the Middle Bronze Age Vatya Culture in Hungary dates approximately between 3,350 cal. BCE (Horváth & Svingor 2015: 33) and 1,600-1,500 cal. BCE (Jaeger & Kulcsár 2013: 313) which corresponds to the Subboreal climatic phase of the Holocene. In this phase, the climate became cooler resulting in the extension of beech in the woodlands, moreover, important technological and social changes also happened parallel to this climatic change (Fischl *et al.* 2013).

At the moment, we have evidence concerning the exploitation method only in Budapest-Farkasrét where 260 mining tools made of antler, knapping waste of chert, and hammerstones have been found in three undisturbed horizontal levels. At the bottom of the excavated area, two extraction pits were also observed (Figure 9). The radiometric dating of the mine was ambiguous (Vörös 1998-1999: 96): the date of 40,350 ± 950 uncal. BP (GrN 15567) from charcoal represents a Middle Palaeolithic age, while the date of 3,470 ± 80 uncal. BP (B 4709) from an antler corresponds to the early Middle Bronze Age. To look for extraction pits or other mining features in the Ördög-orom hill, Végvári-szikla locality, Irhás-árok, and Kavics-árok valleys, the application of geophysical methods and a thorough analysis of the surface morphology are expected in the future. The presence of hammerstones in the Farkas-völgy and Irhás-árok valleys suggest that prehistoric people collected and tested blocks of raw material easily accessible in the slope sediment. It is very important to add the possibility of access to the raw material blocks in the pediment of the foothills. There, the occurrences are located in the continuation of the Irhás-árok valley. It needs further geomorphological investigation for clarifying the origin and the transportation-accumulation process of the chert blocks in the sediment. According to the geological map, there are Pleistocene slope sediments which suggest the secondary autochthonous type of source (Faragó *et al.* 2018). However, if it was linked to the formation of the foothill region like in the Mátra Mountains, these occurrences should be classified as sub-allochthonous sources. It is necessary to evaluate their accessibility in the concerned period of the Holocene. However, this potential source was very close to the Bronze Age settlement of Albertfalva where the use of the Buda hornstone was present (Biró 2002a).

Archaeological studies usually highlight the low quality of the Buda hornstone (Biró 2002a; Horváth 2012; 2017), concluding that it determined the general aspect of the lithic industries: small pieces, flakes, and blade fragments as blanks, splinter technique for blank production. In our understanding, the correlation is inverse: the knappers used the low-quality raw material because it was convenient for their purposes. Production of small arrowheads, saws, and harvesting implements (Horváth 2012) do not require bigger, well-made, or standardized blanks and producing simple flakes does not require sophisticated debitage methods. The Buda hornstone blocks splintered easily into irregular flakes during knapping because of the many cracks inside. So, this raw material property facilitated production. In contrast, the size of the side-scrapers in the Middle Palaeolithic lithic industry at Érd reach 60 - 80 mm, although the average size is 42 mm (Mester & Moncel 2006). The overwhelming majority of the toolkit was made of quartzite pebbles, and no retouched tool was produced of Buda hornstone found at the site.

5. Discussion

Both studied areas have special characteristics differing from each other. The Mátra Mountains are composed of volcanic rocks formed during the Tertiary, while the Buda Hills are built up of Mesozoic sedimentary rocks. At the same time, they have common features too. Both have a long geologic history within the eventful formation of the Carpathians and the Pannonian Basin. Both have a foothill zone formed by erosion in consequence of the uplift of the mountains and the subsidence of the neighbouring lowland. Both have their characteristic local raw material type: the limnosilicites in the Mátra Mountains as well as the Buda hornstone or chert in the Buda Hills. The use of both is documented on archaeological sites from several prehistoric periods. Both materials have many occurrences in the studied areas which could have been considered raw material sources by different prehistoric communities living there.

To assess the problem of raw material sources in the study areas, we evaluate the availability-accessibility-exploitability-appropriateness factors. For this we need to overlap geological, palaeogeographical, and archaeological data, taking into account the abovementioned complex viewpoints. The OSA model is very promising to describe and understand human-lithic resource interaction in both regions.

5.1. Human-lithic resource interaction at Mátraalja

The evaluation of the human-lithic resource interaction dynamism for the study area is difficult because our data presented in Table 2 are collected from the literature. In most of the cases, the authors mention “limnosilicite from the Mátra”. For a detailed analysis, it is essential to check the pieces for identifying variants in the future. Based on the actual dataset, we can draw only a general picture of the lithic resources of the study area as a unit.

In the late Middle Palaeolithic, limnosilicite occurrences were sources for the industries characterized by bifacial tools (Bábonyian, Micoquian). Bearers of these industries probably frequented the region during their movements between the Cserhát and Bükk mountains (confer Markó 2009). The leaf points found near Gyöngyöstarján may be the vestiges of short stops when they travelled across the region (Gutay *et al.* 2010). In the same period, these outcrops were occurrences for Mousterian groups who have based their raw material economy on the sources of the Bükk Mountains and its foothills (cultural choice or limited mobility?) (confer Mester 2004a).

During the Middle to Upper Palaeolithic transition, the Szeletian groups seem to have been continuing the same mobility as that of the Bábonyian and Micoquian groups. So, the resources of the Mátra remained sources for them. In the Early Upper Palaeolithic, the Aurignacian groups had either increased mobility or larger territory because they regularly used long-distance raw materials from outside the Carpathians. For them, the resources of the Mátra were sources. The only known exception is the Nagyréde site where the local limnosilicites dominate the assemblage (Lengyel *et al.* 2006). It represents perhaps a periodically inhabited base camp, exploiting the local raw material sources for producing domestic tools.

During the Middle and Late Upper Palaeolithic, the limnosilicites of the Mátra were occurrences for Late Gravettian groups before the Late Glacial Maximum (LGM). Possibly they did not favour this region at all. During the LGM, Early Epigravettian groups were living in the Carpathian Basin using mainly local and regional raw materials (Lengyel 2014; 2018). The Halmajugra and Feldebrő sites correspond to this pattern (Gutay 2016; Gutay *et al.* 2016). After the LGM, Late Epigravettian groups used extra-Carpathian raw materials again which suggests increasing mobility (Lengyel 2014; 2018). Accordingly, the limnosilicites of the Mátra became sources again, but their limited quantity in the assemblages suggest short visits.

At the beginning of the Holocene, the limnosilicite resources became occurrences again because we do not have any settlement in this part of the Carpathian Basin. Mesolithic groups living in the floodplain of the river Zagyva started to use the limnosilicites of the Mátra from the Boreal period onward (Kertész 2002). According to their limited mobility, they based their lithic tool production essentially on these sources, exploiting perhaps the allochthonous ones.

In the Early Neolithic, the first farmers of the Körös Culture did not know the limnosilicite occurrences. Spreading across the Great Hungarian Plain along the Tisza River, they used both the former sources of the Banat flint and the newly discovered sources of the Carpathian obsidian (Mateiciucová 2007). Spreading towards the north, Neolithic people started to use regional raw materials of the North Hungarian Range, including the Mátra Mountains. The inhabitants of the Middle Neolithic settlement at Apc dominantly used local limnosilicites (Kaczanowska *et al.* 2016). Possibly they exploited directly the archaeological site on the Bánya-domb hill, as far as it should be concluded from the core (Figure 6) which has a structure corresponding to the debitage strategy of the LBK (confer Mester & Tixier 2013). In the Late Neolithic, the limnosilicites of the Mátra remained sources, certainly due to the network of settlements or the supply system (Faragó 2016).

5.2. Human-lithic resource interaction in the Buda Hills

Concerning the evaluation of the human-lithic resource interaction dynamism for the study area, our data presented in Table 2 are more useful than those of the Mátra limnosilicites, although they were collected from the literature as well. That is because, on the one hand, the Buda hornstone is less variable macroscopically than the limnosilicites, and on the other hand, the related studies were conducted after the discovery of the Budapest-Farkasrét extraction site (Faragó *et al.* 2018). These data suggest that the lithic resources in the southern part of the Buda Hills remained occurrences during the entire Palaeolithic and Mesolithic eras. The only known exception is the Middle Palaeolithic site of Érd but this raw material has hardly any importance within the industry (about 2%) (Faragó *et al.* 2018: tab. 1). Even though the ^{14}C date, obtained on charcoal for the Budapest-Farkasrét site, fits quite well into the radiometric age of the occupations of Érd, Middle Palaeolithic mining activity is highly uncertain in the light of actual archaeological evidence. Regarding the technical and social investment necessary to mining, the Neanderthals of Érd most probably collected the fragments of Buda hornstone at the abovementioned sources in the foothills. At present, we cannot explain the lack of evidence of use in the Upper Palaeolithic and Mesolithic. The reason might be simply an archaeological research gap, however, there are some Palaeolithic cave sites in the surrounding mountainous area. During the Late Upper Palaeolithic, a series of open-air sites existed along the Danube Bend between Esztergom and Budapest (Dobosi

2014). The southernmost site is Budapest-Corvin-tér which is located at a distance of only 5 km from the outcrops in the Farkas-völgy valley. Moreover, the Early Epigravettian industry of the site is characterized by small tools (Ringer & Lengyel 2008). Given these circumstances, it could be a cultural decision not to use the local chert.

In the Neolithic, the chert resources of the Buda Hills were occurrences for the inhabitants of the region. Although there were settlements from the Early to the Late Neolithic, actually we do not know any piece of evidence about the use of the Buda hornstone. Perhaps, the reason is the overwhelming dominance of the exploitation (including mining) of the Transdanubian radiolarite sources in the Bakony, Mecsek, and Gerecse mountains (Bácskay 1981; 1995; Biró 1995; 1998a; Mateiciucová 2007).

Significant use of the Buda hornstone firstly can be dated to the Late Copper Age Baden culture, and it became more abundant through the Early Bronze Age Bell-Beaker culture until the Middle Bronze Age tell cultures, namely the Nagyrév and Vatya horizons (Table 2). The spatial distribution of this raw material was restricted to a 50-100 km circle around the outcrops. In these cultural contexts, the communities likely extracted the raw material at the sites in the Farkas-völgy and Irhás-árok valleys. After calibration by OxCal 4.4 (IntCal20), the second date obtained on antler of the Budapest-Farkasrét extraction site corresponds to the beginning of the Middle Bronze Age (Nagyrév and Vatya) (confer Jaeger & Kulcsár 2013). The Nagyrév and Vatya cultural context characterize the Százhalombatta-Földvár site, situated 16 km to the south from the extraction site, where the Buda hornstone dominates the lithic raw materials with 90% (Faragó *et al.* 2018: tab. 1). Similarly, the Budapest-Albertfalva and Budapest-Hollandi-street sites of the Early Bronze Age Bell-Beaker culture, which are the richest in Buda hornstone material with >80% (Faragó *et al.* 2018: tab. 1), are located respectively 6 and 11 km to the south-east from the Farkas-völgy valley. It is most probable that the localities with human impact in the Farkas-völgy and Irhás-árok valleys were not only sources but archaeological sites for these Bronze Age communities.

6. Conclusion

The exploitation of available natural resources is a basic management problem for all human groups or societies. Solving it in practical terms is guided by environmental and cultural factors. The palaeoethnological approach we have chosen for studying this problem is extremely useful because of the complexity it provides to think about. Especially in the case of lithic raw material resources, this complexity is well-expressed. The methodology we apply is inspired by those established by French researchers and proved to be very useful and efficient in the study of the selected regions of Hungary.

Thanks to the complex palaeoethnological approach we applied, our research program revealed similarities and differences in prehistoric lithic raw material procurement in the two study areas. According to Turq's categories, allochthonous type of source is not present, but primary and secondary autochthonous as well as sub-allochthonous types of sources were identified in both areas. However, the exploitation of primary autochthonous sources of limnosilicites could not be demonstrated in the Mátraalja. At the moment, the exploitation of secondary autochthonous and sub-allochthonous sources seems certain for all prehistoric periods encountered. Further field investigation is needed for archaeological evidence of exploitation (extraction pits and tools, debris) at the sources, and dating the human activities. These will allow us to complete and specify the OSA model for the description of the human-lithic resource interaction dynamics in the studied regions.

Moreover, we continue to analyze the lithic assemblages of the region to clarify the same aspect concerning past human behaviour. It needs further confirmation that the Buda hornstone was not considered as raw material by Upper Palaeolithic, Mesolithic, and

Neolithic communities. Until that point, we can only interpret the lack of evidence as a result of research bias. Similarly, the use of the Mátra limnosilicites by the communities of the Copper and Bronze Ages poses a big question because detailed analyses of their lithic assemblages (mainly the knapped industries) are almost non-existent at the moment.

In both study areas, the petrographic characterization of the variants has to be continued together with their diversity of occurrences. The first results in this aspect are promising for the Buda hornstone, while the variability of the limnosilicites seems to be too large. Nevertheless, we hope to find well-recognizable variants, as it is the case of the limnosilicites of the Bükk and the Tokaj mountains (Hartai & Szakáll 2005; Přichystal 2013; Szekszárdi *et al.* 2010).

7. Acknowledgements

We are grateful to Attila Péntek, Zoltán Henrik Tóth, Ferenc Cserpák, Dávid Kraus and Mónika Gutay for informations about their field observations. The "Lithic resource management dynamics from the Middle Palaeolithic to the Middle Neolithic in Northern Hungary" project is financed by the National Research, Development and Innovation Fund (grant no. K 124334). The study of the sources and the prehistoric utilization of the Buda hornstone is a joint research program of the Institute of Archaeological Sciences of the Eötvös Loránd University, Budapest and the Budapest History Museum - Aquincum Museum. Finaly, we are greatly indebted to Attila Király for improving the English text.

Data accessibility statement

The data used here are from the ownership of the authors, and the others are cited. The data presented in this study are available on request from the authors.

References

Allard, P. & Denis, S. 2021, Lithic industries, territory and mobility in the western Linear Pottery Culture. *Journal of Lithic Studies*, 8(1): 1-25. DOI: https://doi.org/10.2218/jls.4444

Andrefsky, W.Jr. 1994, Raw-material availability and the organization of technology. *American Antiquity*, 59(1): 21-34. DOI: https://doi.org/10.2307/3085499

Audouze, F. 1999, New advances in French Prehistory. *Antiquity*, 73: 167-175. DOI: https://doi.org/10.1017/s0003598x00087986

Audouze, F. & Karlin, C. 2017, La chaîne opératoire a 70 ans: qu'en ont fait les préhistoriens français. *Journal of Lithic Studies* 4(2): 5-73. (In French) ("70 years of "*Chaîne opératoire*": What French prehistorians have done with it") DOI: https://doi.org/10.2218/jls.v4i2.2539

Bácskay, E. 1981, Zum Stand der Erforschung prähistorischer Feuersteingruben in Ungarn. In: *5000 Jahre Feiersteinbergbau. Die Suche nach dem Stahl der Steinzeit* (Weisgerber, G., Slotta, R. & Weiner, J., Eds.), Veröffentlichungen aus dem Deutschen Bergbau-Museum Bochum Vol. 22, Deutsches Bergbau-Museum Bochum, Bochum: p. 179-182. (in German) ("About the state of arts of the research of prehistoric flint mines in Hungary")

Bácskay, E. 1995, H2. Sümeg-Mogyorósdomb, Veszprém county. *Archaeologia Polona*, 33: 383-395.

Balogh, É.Cs. 2009, The lithic finds from Budakalász. In: *The Copper age cemetery of Budakalász* (Bondár, M. & Raczky, P., Eds.), Pytheas, Budapest: p. 379-407. URL: http://real.mtak.hu/72325/1/Budakalasz.pdf

Baráz, Cs. & Kiss, G. 2010, A Mátra hegység elnevezése, lehatárolása és tájai. In: *A Mátrai Tájvédelmi Körzet. Heves és Nógrád határán* (Baráz, Cs., Ed.), Bükki Nemzeti Park Igazgatóság, Eger: p. 9-12. (in Hungarian) (“Denomination, limits and lands of the Mátra Mountains”)

Barkai, R., Gopher, A. & La Porta, P.C. 2002, Palaeolithic landscape of extraction: flint surface quarries and workshops at Mt Pua, Israel. *Antiquity*, 76: 672-680. DOI: https://doi.org/10.1017/s0003598x00091110

Beyries, S. 1997, Systèmes techniques et stratégies alimentaires : l’exemple de deux groupes d’indiens de Colombie-Britannique. In: *L’alimentation des hommes du Paléolithique : approche pluridisciplinaire* (Patou-Mathis, M., Ed.), Etudes et Recherches Archéologiques de l'Université de Liège 83, Université de Liège, Liège: p. 73-92. (in French) (“Technical systems and alimentary strategies: two indian groups from British Columbia as an example”)

Binford, L.R. 1979, Organization and formation processes: looking at curated technologies. *Journal of Anthropological Research*, 35(3): 255-273.

Binford, L.R. 1980, Willow Smoke and Dogs’ Tails: Hunter-Gatherer Settlement Systems and Archaeological Site Formation. *American Antiquity*, 45(1): 4-20. DOI: https://doi.org/10.2307/279653

Binford, L.R. 1982, The archaeology of place. *Journal of Anthropological Archaeology*, 1: 5-31. DOI: https://doi.org/10.1016/0278-4165(82)90006-X

Binford, L.R. 2002, *In pursuit of the past: decoding the archaeological record: with a new afterword*. University of California Press, Berkley, 260 p.

Biró, K.T. & Pálosi, M. 1985, A pattintott kőeszközök nyersanyagának forrásai Magyarországon. *A Magyar Állami Földtani Intézet Évi Jelentése az 1983. évről*: 407-435. (in Hungarian) (“Sources of lithic raw materials for chipped artefacts in Hungary”) URL: http://epa.oszk.hu/02900/02934/00012/pdf/EPA02934_mafi_evi_jelentes_1983_407-435.pdf

Biró, K.T. 1984, Őskőkori és őskori pattintott kőeszközeink nyersanyagának forrásai. *Archaeologiai Értesítő*, 111(1): 42-52. (in Hungarian) (“Sources of lithic raw materials for chipped implements in Hungary”). URL: http://real-j.mtak.hu/382/

Biró, K.T. (Ed.) 1986, *Papers for the 1st International Conference on Prehistoric Flint Mining and Lithic Raw Material Identification in the Carpathian Basin*, *Budapest-Sümeg 1986*. Vol. 1, KMI, Budapest, 341 p.

Biró, K.T. (Ed.) 1987, *Papers for the 1st International Conference on Prehistoric Flint Mining and Lithic Raw Material Identification in the Carpathian Basin, Budapest-Sümeg 1986*, Vol. 2, KMI, Budapest, 284 p.

Biró, K.T. 1991, Bell-Beaker culture lithic implements from Hungary. *Acta Archaeologica Carpathica*, 30: 87-96.

Biró, K.T. & Dobosi, V.T. 1991, *Lithotheca - Comparative raw material collection of the Hungarian National Museum*. Magyar Nemzeti Múzeum, Budapest, 268 p.

Biró, K.T. 1995, H8. Szentgál-Tűzköveshegy, Veszprém country. *Archaeologia Polona*, 33: 402-408.

Biró, K.T. 1998a, *Lithic implements and the circulation of raw materials in the Great Hungarian Plain during the Late Neolithic Period*. Hungarian National Museum, Budapest, 350 p.

Biró, K.T. 1998b, Limits and connections. In: *The Roman town in the modern city, Proceedings of the International Colloquium held on the occasion of the 100th anniversary of the Aquincum Museum 1994 Budapest* (Németh, M., Ed.), Aquincum Nostrum Vol. 2, Pro Acquinco Foundation, Budapest: p. 152-157.

Biró, K.T., Dobosi, V.T. & Schléder, Z. 2000, *Lithotheca II - The comparative raw material collection of the Hungarian National Museum* Vol. II. Magyar Nemzeti Múzeum, Budapest, 332 p.

Biró, K.T. 2002a, New data on the utilization of Buda hornstone in the Early Bronze Age. *Budapest Régiségei*, 36: 131-143. URL: https://epa.oszk.hu/02000/02007/00040/pdf/EPA2007_bp_regisegei_36_2002_131-143.pdf

Biró, K.T. 2002b, Advances in the study of Early Neolithic lithic materials in Hungary. *Antaeus*, 25: 119-168. URL: http://real-j.mtak.hu/4595/1/Antaeus_2002.pdf

Biró, K.T. 2004, Provenancing: methods, possibilities, problems. *Antaeus*, 27: 95-110. URL: http://real-j.mtak.hu/4597/1/Antaeus_2004.pdf

Biró, K.T. 2009, Sourcing raw materials for chipped stone artifacts: the state-of-the-art in Hungary and the Carpathian basin. In: *Lithic Materials and Paleolithic Societies* (Adams, B. & Blades, B.S., Eds.), Wiley-Blackwell, Oxford: p. 47-53. DOI: https://doi.org/10.1002/9781444311976.ch4

Biró, K.T. 2010, Terminological practice for siliceous rocks in Hungary from petroarchaeological point of view. *Archeometriai Műhely*, 7(3): 195-201. URL: http://www.ace.hu/am/2010_3/AM-10-03-TBK.pdf

Bonjean, D. & Otte, M. 2004, Une organisation fonctionelle de l'espace d'habitat. Le cas de la grotte Scladina (Sclayn, Belgique). In: *Settlement dynamics of the Middle Paleolithic and Middle Stone Age. Volume II* (Conard, N.J., Ed.), Kerns Verlag, Tübingen: p. 261-271. (in French) ("A functional organization of the living space. The case of Scladina Cave (Sclayn, Belgium)")

Bracco, J.-P. 2001, De quoi parlons-nous? Réflexions sur l'appréhension des territoires en Préhistoire paléolithique. In: *Territoires, déplacements mobilité, échanges durant la Préhistoire. Terres et hommes du Sud* (Jaubert, J. & Barbaza, M., Eds.), Ed. du CTHS, Paris: p. 13-16. (in French) ("What are we talking about? Reflexions on the apprehension of territories in Palaeolithic Prehistory")

Brandl, M. 2014, Genesis, provenance and classification of rocks within the chert group in Central Europe. *Archaeologica Austriaca*, 97-98 (2013-2014): 33-58. DOI: https://doi.org/10.1553/archaeologia97-98s33

Budai, T. 2009, Geological setting of Hungary. In: *Geological map of Hungary for tourists - 1:200 000* (Budai, T. & Gyalog, L., Eds.), Geological Institute of Hungary, Budapest: p. 7-9.

Budai, T. & Maros, Gy. 2016, Geological history of the area and its tectonic evolution. In: *Budapest Geoguide* (Gyalog, L., Maros, G. & Pelikán, P., Eds.), Magyar Földtani és Geofizikai Intézet, Budapest: p. 14-20. URL: http://real.mtak.hu/48136/1/Geokalauz_teljes_kisebb.pdf

Budziszewski, J., Jakubczak, M., Radziszewska, K. & Szubski, M. 2019, Prehistoric flint mine detection by airborne laser scanning (ALS). Experiences from Poland 2011-2015. *Anthropologica et Præhistorica*, 128(2017): 143-156. URL: https://biblio.naturalsciences.be/associated_publications/anthropologica-prehistorica/anthropologica-et-praehistorica/ap-128/ap128-uispp_143-156_budziszewski-et-al-07012020-600-cmjn-final.pdf

Csongrádiné Balogh, É. 1992, Szigetszentmiklós-Üdülősor kora bronzkori telepének kőeszköz vizsgálata. In: *Régészeti kutatások az M0 autópálya nyomvonalán I* (Havassy, P. & Selmeczi, L., Eds.), BTM Műhely Vol. 5/1, Budapesti Történeti Múzeum, Budapest: p. 201-211. (in Hungarian) ("Lithic analysis of the Early Bronze Age settlement of Szigetszentmiklós-Üdülősor site")

Csongrádiné Balogh, É. 1998, Tipológiai és traszeológiai vizsgálatok rézkori és bronzkori pattintott kőeszközökön. *Folia Archaeologica*, 47: 13-41. (in Hungarian) ("Typological and traceological studies on knapped stone tools from Copper and Bronze Ages")

Csongrádiné Balogh, É. 2001, Adatok a rézkori, bronzkori pattintott kőeszközök tipológiai értékeléséhez (Jász-Nagykun-Szolnok megye). *Tisicum*, 12: 91-106. (in Hungarian) ("Data for typological evaluation of knapped stone tools from Copper and Bronze Ages")

Daschek, É.J. & Mester, Zs. 2020, A site with mixed occupation: Neanderthals and carnivores at Érd (Hungary). *Journal of Archaeological Science: Reports*, 29: 102116. DOI: https://doi.org/10.1016/j.jasrep.2019.102116

Delvigne, V., Fernandes, P., Piboule, M., Bindon, P., Chomette, D., Defive, E., Lafarge, A., Liabeuf, R., Moncel, M.-H., Vaissié, E., Wragg-Sykes, R. & Raynal, J.-P. 2019, Barremian-Bedoulian flint humanly transported from the west bank of the Rhône to the Massif-Central Highlands - A diachronic perspective. *Comptes Rendus Palevol*, 18: 90-112. DOI: https://doi.org/10.1016/j.crpv.2018.06.005

Dienes, I. 1968, Examen pétrographique de l'industrie. In: *La station du Paléolithique moyen d'Érd - Hongrie* (Gábori-Csánk, V., Ed.), Akadémiai Kiadó, Budapest: p. 111-114. (in French) ("Petrographic examination of the industry")

Djindjian, F. 2009, Le concept de territoires pour les chasseurs cueilleurs du Paléolithiqe supérieur européen. In: *Le concept de territoires dans le Paléolithiqe supérieur européen* (Djindjian, F., Kozlowski, J. & Bicho, N., Eds.), BAR International Series Vol. 1938, Archaeopress, Oxford: p. 3-25. (in French) ("The concept of territories for hunter-gatherers of the European Upper Palaeolithic")

Djindjian, F. 2012, Is the MP-EUP transition also an economic and social revolution? *Quaternary International*, 259: 72-77. DOI: https://doi.org/10.1016/j.quaint.2011.03.040

Dobosi, V.T. 1997, Raw material management of the Upper Palaeolithic (A case study of five new sites). In: *Man and flint* (Schild, R. & Sulgostowska, Z., Eds.), Institute of Archaeology and Ethnology Polish Academy of Sciences, Warszawa: p. 189-193.

Dobosi, V.T. 2001, Antecedents: Upper Palaeolithic in the Jászság region. In: *From the Mesolithic to the Neolithic. Proceedings of the International Archaeological Conference held in the Damjanich Museum of Szolnok, September 22-27, 1996* (Kertész, R. & Makkay, J., Eds.), Archaeolingua, Budapest: p. 177-191.

Dobosi, V. 2009, Filling the void: Lithic raw material utilization during the Hungarian Gravettian. In: *Lithic materials and Paleolithic societies* (Adams, B. & Blades, B.S., Eds.), Wiley-Blackwell, Oxford: p. 116-126. DOI: https://doi.org/10.1002/9781444311976.ch8

Dobosi, V.T. 2014, A Dunakanyar felső paleolitikuma. *Archaeologiai Értesítő*, 139: 7-33. (in Hungarian) ("The Upper Palaeolithic of the Danube Bend") DOI: https://doi.org/10.1556/archert.139.2014.1

Domboróczki, L., Kaczanowska, M. & Kozłowski, J.K. 2010, The Neolithic settlement at Tiszaszőlős-Domaháza-puszta and the question of the northern spread of the Körös Culture. *Atti della Società per la Preistoria e Protostoria della Regione Friuli-Venezia Giulia*, 17 (2008-2009): 101-155.

Dövényi, Z. (Ed.) 2010, *Magyarország kistájainak katasztere*. MTA Földrajztudományi Kutatóintézet, Budapest, 876 p. (in Hungarian) ("Cadastre of the lands of Hungary")

Faragó, N. 2016, Houses, households, activity zones in the post-LBK world. Results of the raw material analysis of the chipped stone tools at Polgár-Csőszhalom, Northeast Hungary. *Open Archaeology*, 2(1): 346-367. doi: https://doi.org/10.1515/opar-2016-0024

Faragó, N., Péter, R.K., Cserpák, F., Kraus, D. & Mester, Zs. 2018, New perspectives on the problems of the exploitation area and the prehistoric use of the Buda hornstone in Hungary. *Archaeologia Polona*, 56: 167-189. DOI: https://doi.org/10.23858/apa56.2018.011

Féblot-Augustins, J. 1990, Exploitation des matières premières dans l'Acheuléen d'Afrique : perspectives comportementales. *Paléo*, 2: 27-42. (in French) ("Raw material exploitation in the Acheulian of Africa: behavioural perspectives") URL: https://www.persee.fr/doc/pal_1145-3370_1990_num_2_1_987

Féblot-Augustins, J. 1997, *La circulation des matières premières au Paléolithique*. Etudes et Recherches Archéologiques de l'Université de Liège Vol. 75, Université de Liège, Liège, 275 p. (in French) ("The raw material circulation in the Palaeolithic")

Féblot-Augustins, J. 1999, La mobilité des groupes paléolithiques. *Bulletins et Mémoires de la Société d'Anthropologie de Paris*, 11(3-4): 219-260. (in French) ("The mobility of Palaeolithic human groups") URL: https://www.persee.fr/doc/bmsap_0037-8984_1999_num_11_3_2551

Féblot-Augustins, J. 2009a, Revisiting European Upper Paleolithic raw material transfers: the demise of the cultural ecological paradigm? In: *Lithic materials and Paleolithic societies* (Adams, B. & Blades, B.S., Eds.), Wiley-Blackwell, Oxford: p. 25-46. DOI: https://doi.org/10.1002/9781444311976.ch3

Féblot-Augustins, J. 2009b, Les ressources siliceuses du Bugey: caractérisation pétrographique des matières premières. In: *La grotte du Gardon (Ain). Volume I: Le site et la séquence néolithique des couches 60 à 47* (Voruz, J.L., Ed.), CRPPM-EHES, Toulouse: p. 167-200. (in French) ("The siliceous resources of the Bugey region: petrographic characterization of the raw materials")

Féblot-Augustins, J. 2009c, Les matières premières des couches 64 à 48: provenances et modalités d'exploitation. In: *La grotte du Gardon (Ain). Volume I: Le site et la séquence néolithique des couches 60 à 47* (Voruz, J.L., Ed.), CRPPM-EHES, Toulouse: p. 325-358. (in French) ("Raw materials of layers 64 to 48: provenance and modes of exploitation")

Fernandes, P. & Raynal, J.-P., 2006, Pétroarchéologie du silex : un retour aux sources. *Comptes Rendus Palevol*, 5: 829-837. (in French) ("Petroarchaeology of the flint: a return to the sources") DOI: https://doi.org/10.1016/j.crpv.2006.04.002

Fernandes, P., Le Bourdonnec, F.-X., Raynal, J.-P., Poupeau, G., Piboule, M. & Moncel, M.-H. 2007, Origins of prehistoric flints: The neocortexmemory revealed by scanning electron microscopy. *Comptes Rendus Palevol*, 6: 557-568. DOI: https://doi.org/10.1016/j.crpv.2007.09.015

Fernandes, P. & Raynal, J.-P. 2010, Silex: une pétroarchéologie refondée. *Les c@hiers de Géopré*, 1: 68-81. (in French) ("Flint: a refunded petroarchaeology")

Fischl, K.P., Kiss, V., Kulcsár, G. & Szeverényi, V. 2013, Transformations in the Carpathian Basin around 1600 B. C. In: *1600 - Cultural change in the shadow of the Thera-Eruption?* (Meller, H., Ed.), Tagungen des Landesmuseums für Vorgeschichte Halle Vol. 9, Landesamt für Denkmalpflege und Archäologie Sachsen-Anhalt - Landesmuseum für Vorgeschichte, Halle: p. 355-372.

Fober, L. & Weisgerber, G. 1981, Feuersteinbergbau - Typen und Techniken. In: *5000 Jahre Feuersteinbergbau. Die Suche nach dem Stahl der Steinzeit* (Weisgerber, G., Slotta, R. & Weiner, J., Eds.), Veröffentlichungen aus dem Deutschen Bergbau-Museum Bochum Vol. 22, Deutsches Bergbau-Museum Bochum, Bochum: p. 32-47. (in German) ("Flint mining - types and techniques")

Gábori-Csánk, V. 1988, Une mine de silex paléolithique à Budapest, Hongrie. In: *Upper Pleistocene Prehistory of Western Eurasia* (Dibble, H.L. & Montet-White, A., Eds.), University Museum Monograph Vol. 54, University Museum, Philadelphia: p. 141-143. (in French) ("A palaeolithic flint mine in Budapest, Hungary")

Gamble, C. 1999, *The Palaeolithic societies of Europe*. Cambridge University Press, Cambridge, 505 p.

Geneste, J.-M. 1988, Systèmes d'approvisionnement en matières premières au Paléolithique moyen et au Paléolithique supérieur en Aquitaine. In: *L'Homme de Néandertal : Actes du colloque international de Liège (4-7 décembre 1986). Volume 8 : La mutation* (Kozlowski, J.K., Ed.), Etudes et Recherches Archéologiques de l'Université de Liège Vol. 35, Université de Liège, Liège: p. 61-70. (in French) ("Raw material supplying systems in the Middle and Upper Palaeolithic in Aquitaine")

Geneste, J.-M. 1989, Économie des ressources lithiques dans le Moustérien du Sud-Ouest de la France. In: *L'Homme de Néandertal : Actes du colloque international de Liège (4-7 décembre 1986). Volume 6: La subsistence* (Freeman, L. & Patou, M., Eds.), Etudes et Recherches Archéologiques de l'Université de Liège Vol. 33, Université de Liège, Liège: p. 75-97. (In French) ("Lithic resource economy in the Mousterian of Southwestern France")

Geneste, J.-M. 1991, Systèmes techniques de production lithique: variations techno-économiques dans les processus de réalisation des outillages paléolithiques. *Techniques & culture*, 17-18: 1-35. (in French) ("Technical systems of the lithic production: techno-economic variations in the processes of the realization of palaeolithic stone tool-kits") DOI: https://doi.org/10.4000/tc.5013

Gutay, M., Kerékgyártó, Gy. & Kecskeméti, A. 2010, Bifaciális levélhegyek a Mátraaljáról. *Ősrégészeti Levelek*, 12: 12-17. (in Hungarian) ("Bifacial leaf points from the Mátra Mountains")

Gutay, M. 2016, Előzetes jelentés a Halmajugra, Szoller-dűlői felső paleolitikus telep leletmentő feltárásairól. *Agria*, 49: 9-15. (in Hungarian) ("Preliminary report on the rescue excavation of Halmajugra-Szoller-dűlő Upper Palaeolithic site")

Gutay, M., Bálint, Cs., Péntek, A., Szegedi, K.I. & Tóth, Z.H. 2016, Feldebrő-Bakoldal 1. számú lelőhely kutatásának előzetes eredményei. *Litikum*, 4: 45-52. (in Hungarian) ("Preliminary report of an Upper Palaeolithic site Feldebrő-Bakoldal 1") DOI: https://doi.org/10.23898/litikuma0018

Gyalog, L. (Ed.) 2005, *Magyarázó Magyarország fedett földtani térképéhez (az egységek rövid leírása) 1:100 000*. A Magyar Állami Földtani Intézet térképmagyarázói, Magyar Állami Földtani Intézet, Budapest, 188p. (in Hungarian) ("Explanatory book for the covered geological map of Hungary (short descriptions of the units) 1:100,000") URL: https://mek.oszk.hu/08700/08714/08714.pdf

Haas, J. (Ed.) 2012, *Geology of Hungary. Regional geology reviews series*. Springer, Heidelberg, 589 p. DOI: https://doi.org/10.1007/978-3-642-21910-8

Harangi, S. 2001, Neogen to Quaternary volcanism of the Carpathian-Pannonian Region - a review. *Acta Geologica Hungarica*, 44 (2-3): 223-258. URL: http://real-j.mtak.hu/2997/1/ActaGeologica_44.pdf

Harangi, S. & Lenkey, L. 2007, Genesis of the Neogene to Quaternary volcanism in the Carpathian-Pannonian region: Role of subduction, extension, and mantle plume. In: *Cenozoic Volcanism in the Mediterranean Area* (Beccaluva, L., Bianchini, G. & Wilson, M., Eds.), Geological Society of America Special Paper Vol. 418, Geological Society of America, Boulder: p. 67-92. DOI: https://doi.org/10.1130/2007.2418(04)

Harangi, S. & Lukács, R. 2019, A Kárpát-Pannon térség neogén-kvarter vulkanizmusa és geodinamikai kapcsolata. *Földtani Közlöny*, 149 (3): 197-232. (in Hungarian) ("The Neogene to Quaternary volcanism and its geodynamic relations in the Carpathian-Pannonian region") DOI: https://doi.org/10.23928/foldt.kozl.2019.149.3.197

Hartai, É. & Szakáll, S. 2005, Geological and mineralogical background of the Palaeolithic chert mining on the Avas Hill, Miskolc, Hungary. *Praehistoria*, 6: 15-21.

Horváth, T. 2005, Stone finds from excavation seasons 1998, 1999, 2000 and 2001. Techno-typological analysis. In: *Százhalombatta Archaeological Expedition SAX Annual Report 2* (Poroszlai, I. & Vicze, M., Eds.), "Matrica" Museum, Százhalombatta: p. 135-155.

Horváth, T. 2012, The chronological role of chipped stone implements in the Early and Middle Bronze Ages. In: *Enclosed space - open society. contact and exchange in the context of Bronze Age fortified settlements in Central Europe* (Jaeger, M., Czebreszuk, J. & Fischl, K.P., Eds.), Studien zur Archäologie in Ostmitteleuropa Vol. 9, Bogucki Wydawnictwo Naukowe-Dr. Rudolf Habelt GmbH, Poznań-Bonn: p. 117-166.

Horváth, T. & Svingor, É. 2015, The spatial and chronological distribution of the so-called "Baden culture". In: *The Baden Culture around the Western Carpathians* (Nowak, M. & Zastawny, A., Eds.), Krakowski Zespół do Badań Autostrad, Kraków: p. 19-74.

Horváth, T. 2017, The stone implements and wrist-guards of the Bell Beaker cemetery of Budakalász (M0/12). *Vjesnik Arheoloskog Muzeja u Zagrebu*, 50: 71-118. URL: https://hrcak.srce.hr/191998

Horváth, T., Kozák, M. & Pető, A. 2000a, Újabb adatok a középső bronzkor kőiparához: Bölcske-Vörösgyír bronzkori tell-település kőanyagának komplex (petrográfiai, régészeti) feldolgozása. Komárom-Esztergom Megyei Önkormányzat Múzeumainak Közleményei, 7: 187-235. (in Hungarian) ("New data for the lithic industry of the Middle Bronze Age: complex (petrographic, archaeological) analysis of the lithic assemblage of the Bronze Age tell-settlement of Bölcske-Vörösgyír site") URL: http://real.mtak.hu/7824/1/KMMK_2000.pdf

Horváth, T., Kozák, M. & Pető, A. 2000b, Complex analysis of stone industry on the Százhalombatta-Földvár (Early and Middle Bronze Age). In: *Százhalombatta Archaeological Expedition SAX Annual Report 1* (Poroszlai, I. & Vicze, M., Eds.), "Matrica" Museum, Százhalombatta: p. 103-119.

Horváth, Z., Michéli, E., Mindszenty, A. & Berényi Üveges, J. 2002, Posztpannóniai környezetváltozásra utaló terepi és mikromorfológiai sajátosságok a visontai lignitösszlet fedőrétegsorában (Visonta, Észak-Magyarország). *Földtani Közlöny*, 132: 53-69. (in Hungarian) ("Environmental change reflected by a post-Pannonian soil/sedimentary complex. Geology and micromorphology of the cover sequence of the Visonta lignite deposite (Mátra Hills, Northern-Hungary)") URL: http://epa.oszk.hu/01600/01635/00302/pdf/EPA01635_foldtani_kozlony_2002_132_ksz_053-069.pdf

Howey, M.C.L. & O'Shea, J.M. 2006, Bear's journey and the study of ritual in archaeology. *American Antiquity*, 71(2): 261-282. DOI: https://doi.org/10.2307/40035905

Inizan, M.-L., Reduron-Ballinger, M., Roche, H. & Tixier, J. 1999, Technology and terminology of knapped stone. Préhistoire de la pierre taillée 5, Cercle de Recherches et d'Etudes Prehistoriques, Nanterre, 189 p.

Jaeger, M. & Kulcsár, G. 2013, Kakucs-Balla-domb. A case study in the absolute and relative chronology of the Vatya culture. *Acta Archaeologica Academiae Scientiarum Hungaricae*, 64(2): 289-320. DOI: https://doi.org/10.1556/aarch.64.2013.2.2

Kaczanowska, M., Kozłowski, J.K. & Sümegi, P. 2009, Lithic industries from the Öcsöd-Kováshalom tell-like settlement in Hungary. In: *Ten years after: The Neolithic of the Balkans, as uncovered by the last decade of research. Proceedings of the Conference held at the Museum of Banat on November 9th-10th, 2007* (Drașovean, F., Ciobotaru, D.L. & Maddison, M., Eds.), Bibliotheca historica et archaeologica banatica Vol. 49, Editura Marineasa, Timișoara: p. 125-149.

Kaczanowska, M., Kozłowski, J.K. & Wasilewski, M. 2016, Linear Band Pottery culture (LBK) lithic industry from Apc. *Archaeologiai Értesítő*, 141: 29-54. DOI: https://doi.org/10.1556/0208.2016.141.2

Kadić, O. 1916, Ergebnisse der Erforschung der Szeletahöhle. *Mitteilungen aus dem Jahrbuche der königlichen Ungarischen Geologischen Reichsanstalt*, 23: 161-301. (in German) ("Results of the investigation of Szeleta cave")

Karátson, G. 2006, Aspects of Quaternary relief evolution of Miocene volcanic areas in Hungary: A review. *Acta Geologica Hungarica*, 49: 285-309. DOI: https://doi.org/10.1556/ageol.49.2006.4.1

Karádi, V., Pelikán, P. & Haas, J. 2016, A Budai-hegység felső-triász medence kifejlődésű dolomitjainak conodonta biosztratigráfiája. *Földtani Közlöny*, 146(4): 371-386. (in Hungarian) ("Conodont biostratigraphy of Upper Triassic dolomites of the Buda Hills (Transdanubian Range, Hungary)") URL: http://real.mtak.hu/47147/1/karadi_et_al_2016_budai-hg_triasz.pdf

Károly, E. 1936, Szarukövek a Budai hegységben. *Földtani Közlöny*, 66(10-12): 254-277. (in Hungarian) ("Hornstones in the Buda Mountains") URL: http://epa.oszk.hu/01600/01635/00399/pdf/EPA01635_foldtani_kozlony_1936_66_10-12_254-277.pdf

Karlin, C., Bodu, P. &, Pelegrin, J. 1991, Processus technique et chaînes opératoires : comment les préhistoriens s'approprient un concept élaboré par les ethnologues. In: *Observer l'action technique: des chaînes opératoires, pour quoi faire?* (Balfet, H., Ed.), Editions du Centre National de la Recherche Scientifique, Paris: p. 97-113. (in French) ("Technical processes and chaînes opératoires: How prehistorians appropriate a concept elaborated by the ethnologists")

Kertész, R., Sümegi, P., Kozák, M., Braun, M., Félegyházi, E. & Hertelendi, E. 1994, Mesolithikum im nördlichen Teil der Großen Ungarischen Tiefebene. *Jósa András Múzeum Évkönyve*, 36: 15-61. (in German) („The Mesolithic in the northern part of the Great Hungarian Plain") URL: http://epa.oszk.hu/01600/01614/00017/pdf/nyjame_36_1994_15-62.pdf

Kertész, R. 2002, Mesolithic hunter-gatherers in the northwestern part of the Great Hungarian Plain. *Praehistoria*, 3: 281-304.

Király A., Faragó N. & Mester Z. 2020, Hasznos rítusok és haszontalan technikák. A rituális cselekvés régészeti azonosításának néhány elméleti kérdése egy pattintott kő leletegyüttes kapcsán. In: *ΜΩΜΟΣ IX. - A rituálé régészete - Őskoros Kutatók IX. Összejövetelének konferenciakötete, Miskolc, 2015. okt. 14-16.- The Archaeology of Ritual - Proceedings of the IXth conference of researchers of prehistory, 14-16 October 2015, Miskolc* (Csengeri, P., Kalli, A., Király, Á. & Koós, J., Eds.), Dissertationes Archaeologicae ex Instituto Archaeologico Universitatis de Rolando Eötvös nominatae Supplementum Vol. 3, Eötvös Loránd University, Institute of Archaeological Sciences, Budapest: p. 9-41. (in Hungarian) ("Useful rites and unfit techniques. Thoughts about archaeological perception of ritual") DOI: https://doi.org/10.17204/dissarch.suppl3.9

Kozlowski, J.K. 1991, Paleolithic quarry sites. In: *Raw material economies among prehistoric hunter-gatherers* (Montet-White, A. & Holen, S., Eds.), Publications in Anthropology Vol. 19, University of Kansas, Lawrence: p. 1-6.

Kozłowski, J.K. & Mester, Z. 2003, Un nouveau site du Paléolithique supérieur dans la région d'Eger (Nord-est de la Hongrie). *Praehistoria*, 4-5: 109-140. (in French) ("A new Upper Palaeolithic site in the Eger region")

Kozłowski, J.K. 2004, La néolithisation de la zone balkano-danubienne et l'occupation du territoire. *Civilisations*, 52(1): 9-24. (in French) ("The neolitization of the Balkano-Danubian zone and the occupation of the territory") DOI: https://doi.org/10.4000/civilisations.733

Lech, J. 2003, Mining and siliceous rock supply to the Danubian early farming communities (LBK) in Eastern Central Europe: A second approach. In: *Production and Management of Lithic Materials in the European Linearbandkeramik* (Burnez-Lanotte, L., Ed.), BAR International Series Vol. 1200, Archaeopress, Oxford: p. 19-30.

Lemonnier, P. 1983, L'étude des systèmes techniques: une urgence en technologie culturelle. *Techniques & culture*, 1: 11-26. (in French) ("Studying the technical systems: an urgency in cultural technology") DOI: https://doi.org/10.4000/tc.1038

Lemonnier, P. 1986, The study of material culture today: Toward an anthropology of technical systems. *Journal of Anthropological Archaeology*, 5: 147-186. DOI: https://doi.org/10.1016/0278-4165(86)90012-7

Lengyel, G. 2014, Distant connection changes from the Early Gravettian to the Epigravettian in Hungary. In: *Modes de contacts et de déplacements au Paléolithique eurasiatique. Modes of contact and mobility during the Eurasian Palaeolithic* (Otte, M. & Le Brun-Ricalens, F., Eds.), Etudes et Recherches Archéologiques de Université de Liège Vol. 140 and ArchéoLogiques Vol. 5, Université de Liège-Centre National de Recherche Archéologique, Luxembourg: p. 331-347.

Lengyel, G. 2018, Lithic analysis of the Middle and Late Upper Palaeolithic in Hungary. *Folia Quaternaria*, 86: 5-157. DOI: https://doi.org/10.4467/21995923fq.18.001.9819

Lengyel, G., Béres, S. & Fodor, L. 2006, New lithic evidence of the Aurignacian in Hungary. *Eurasian Prehistory*, 4: 79-85. URL: http://real.mtak.hu/3602/1/1071129.pdf

Leroi-Gourhan, A. & Brézillon, M. 1972, *Fouilles de Pincevent. Essai d'analyse ethnographique d'un habitat magdalénien (La section 36)*. VIIe supplément à "Gallia Préhistoire". Éditions du Centre National de la Recherche Scientifique, Paris, 345 p. (in French) ("Excavations at Pincevent. An attempt to make an ethnographical analysis of a Magdalenian settlement (The section 36)")

Loodts, I. 1998, Une approche comportementale de l'Homme de Néandertal. L'industrie lithique de la couche 1A de la grotte Scladina, économie des matières premières et coexistence de chaînes opératoires au Paléolithique moyen récent. In: *Recherches aux grottes de Sclayn. Volume 2, L'archéologie* (Otte, M., Patou-Mathis, M. & Bonjean, D., Eds.), Etudes et Recherches Archéologiques de l'Université de Liège Vol. 79, Université de Liège, Liège: p. 69-101. (in French) ("A behavioural approach to Neanderthal Man. Lithic industry of layer 1A of Scladina cave, raw material economy and coexistence of chaînes opératoires in the Late Middle Palaeolithic")

Markó, A. & Péntek, A. 2003, Raw material procurement strategy on the Palaeolithic site Legénd-Káldy-farm (Cserhát Mountains, Northern Hungary). *Praehistoria*, 4-5: 165-177.

Markó, A. 2009, Raw material circulation during the Middle Palaeolithic period in northern Hungary. In: *Surowce naturalne w Karpatach oraz ich wykorzystanie w pradziejach i wczesnym średniowieczu* (Gancarski, J., Ed.), Muzeum Podkarpackie w Krośnie, Krosno: p. 107-120.

Mateiciucová, I. 2007, Worked stone: obsidian and flint. In: *The Early Neolithic on the Great Hungarian Plain. Investigations of the Körös Culture site of Ecsegfalva 23, County Békés* (Whittle, A., Ed.), Varia Archaeologica Hungarica Vol. 21, Institute of Archaeology HAS, Budapest: p. 677-726.

Mellars, P., 2011, The earliest modern humans in Europe. *Nature*, 479: 483-484. DOI: https://doi.org/10.1038/479483a

Mester, Zs. 2004a, Technologie des industries moustériennes de la grotte Suba-lyuk (Hongrie). In: *Actes du XIVe Congrès UISPP, Université de Liège, Belgique, 2-8 septembre 2001. Section 5: Le Paléolithique moyen: Sessions générales et posters* (Le

Secrétariat du Congrès, Ed.), BAR International Series Vol. 1239, Archaeopress, Oxford: p. 127-133. (in French) ("Technology of the Mousterian industries of Subalyuk cave (Hungary)")

Mester, Zs. 2004b, La production lithique à la station d'Érd (Hongrie). In: *Die aktuellen Fragen des Mittelpaläolithikums in Mitteleuropa - Topical issues of the research of Middle Palaeolithic period in Central Europe* (Fülöp, É. & Cseh, J., Eds.), Tudományos Füzetek Vol. 12, Komárom-Esztergom County Museum Directorate, Tata: p. 233-250. (in French) ("The lithic production at the site of Érd (Hungary)") URL: https://mek.oszk.hu/09800/09802/09802.pdf

Mester, Zs. 2009, Nyersanyagbeszerzés és -feldolgozás egy felső paleolit telepen: Andornaktálya-Zúgó-dűlő. In: *ΜΩΜΟΣ VI. - Őskoros Kutatók VI. Összejövetelének konferenciakötete. Nyersanyagok és kereskedelem. Kőszeg, 2009. március 19 - 21* (Ilon, G., Ed.), Kulturális Örökségvédelmi Szakszolgálat Budapest-Vas megyei Múzeumok Igazgatósága Szombathely, Szombathely: p. 239-254. (in Hungarian) ("Raw material acquisition and processing at an Upper Palaeolithic settlement: Andornaktálya-Zúgó-dűlő")

Mester, Zs. 2013, The lithic raw material sources and interregional human contacts in the Northern Carpathian regions: Aims and methodology. In: *The lithic raw material sources and interregional human contacts in the Northern Carpathian regions* (Mester, Zs., Ed.), Polish Academy of Arts and Sciences-Institute of Archaeological Sciences of the Eötvös Loránd University, Kraków-Budapest: p. 9-21.

Mester, Zs. 2019, A műveletsortól a technikai rendszerig: a paleoetnológiai szemlélet hasznossága a technológiai kutatásban. In: *ΜΩΜΟΣ X. - Őskoros Kutatók X. Összejövetelének konferenciakötete - Őskori technikák, őskori technológiák, Százhalombatta, 2017. ápr. 6-8* (Vicze, M. & Kovács, G., Eds.), „Matrica" Múzeum, Százhalombatta: p. 255-270. (in Hungarian) ("From the chaîne opératoire to the technical system: the usefulness of the palaeoethnologic approach in technological research")

Mester, Zs. & Faragó, N. 2013, The lithic raw material sources and interregional human contacts in the Northern Carpathian regions: Report and preliminary results of the field surveys. In: *The lithic raw material sources and interregional human contacts in the Northern Carpathian regions* (Mester, Zs., Ed.), Polish Academy of Arts and Sciences-Institute of Archaeological Sciences of the Eötvös Loránd University, Kraków-Budapest: p. 23-37.

Mester, Zs. & Faragó, N. 2016, Prehistoric exploitations of limnosilicites in Northern Hungary: problems and perspectives. *Archaeologia Polona*, 54: 33-50. URL: https://rcin.org.pl/publication/83007

Mester, Zs. & Kozłowski, J.K. 2014, Modes de contacts des Aurignaciens du site d'Andornaktálya (Hongrie) à la lumière de leur économie particulière de matières premières. In: *Modes de contacts et de déplacements au Paléolithique eurasiatique. Modes of contact and mobility during the Eurasian Palaeolithic* (Otte, M. & Le Brun-Ricalens, F., Eds.), Etudes et Recherches Archéologiques de Université de Liège Vol. 140 and ArchéoLogiques Vol. 5, Université de Liège-Centre National de Recherche Archéologique, Luxembourg: p. 349-367. (in French) ("Modes of contact of the Aurignacian people at Andornaktálya site (Hungary) in the light of their particular raw material economy")

Mester, Zs. & Moncel, M.-H. 2006, Le site paléolithique moyen d'Érd (Hongrie) : nouvelles données sur les chaînes opératoires et résultats morpho-fonctionnels de la production. *Anthropologie (Brno)*, 44(3): 221-240. (in French) ("The Middle Palaeolithic site of Érd (Hungary): new data about the chaînes opératoires and the morpho-functional results of the production") URL: https://www.jstor.org/stable/10.2307/26292781

Mester, Zs. & Rácz, B. 2010, The spread of the Körös Culture and the raw material sources in the northeastern part of the Carpathian Basin: a research project. In: *Neolithization of the Carpathian Basin: Northernmost distribution of the Starčevo/Körös Culture* (Kozłowski, J.K. & Raczky, P., Eds.), Polish Academy of Arts and Sciences-Institute of Archaeological Sciences of the Eötvös Loránd University, Kraków-Budapest: p. 23-35.

Mester, Zs. & Tixier, J. 2013, "Pot à lames": The Neolithic blade depot from Boldogkőváralja (Northeast Hungary). In: *Moments in time. Papers presented to Pál Raczky on his 60th birthday* (Anders, A. & Kulcsár, G., Eds.), Ősrégészeti Tanulmányok/Prehistoric Studies Vol. 1, Ősrégészeti Társaság/Prehistoric Society-Eötvös Loránd University-L'Harmattan, Budapest: p. 173-185.

Mester, Zs., Faragó, N. & Lengyel, Gy. 2012, The lithic raw material sources and interregional human contacts in the northern Carpathian regions: A research program. *Anthropologie (Brno)*, 50(3): 275-293. URL: http://puvodni.mzm.cz/Anthropologie/downloads/articles/2012/Mester_2012_p275-293.pdf

Mester, Zs., Kozłowski, J.K., Kalicki, T., Dobos, A., Frączek, M., Zandler, K., Gutay, M., Béres, S. & Cserpák, F. 2021, Nouveaux assemblages du Paléolithique supérieur ancien en Hongrie du nord dans le contexte de l'hypothèse du Couloir danubien. *L'Anthropologie*, 125: 102914. (in French) ("New assemblages of the Early Upper Palaeolithic in Northern Hungary in the context of the Danube Corridor hypothesis") DOI: HTTPS://DOI.ORG/10.1016/j.anthro.2021.102914

Michéli, E. & Mindszenty, A. 2002, A negyedidőszaki környezetváltozások hatása a talajképződésre a Mátra és a Mátraelőtér példáján. *Földtani Közlöny*, 132: 43-51. (in Hungarian) ("The imprints of Quaternary environmental change preserved in the Pleistocene soil-scape. Examples from the Mátra Foothills") URL: http://epa.oszk.hu/01600/01635/00302/pdf/EPA01635_foldtani_kozlony_2002_132_ksz_043-051.pdf

Miller, R. 1997, Variability in lithic assemblages across space: Differential responses to raw material context. *Notae Praehistoricae*, 17: 53-62. URL: http://biblio.naturalsciences.be/associated_publications/notae-praehistoricae/NP17/np17_53-62.pdf

Oliva, M. 2009, Le concept de territoire dans le Paléolithiqe supérieur morave. In: *Le concept de territoires dans le Paléolithiqe supérieur européen* (Djindjian, F., Kozlowski, J. & Bicho, N., Eds.), BAR International Series Vol. 1938, Archaeopress, Oxford: p. 103-110. (in French) ("The concept of territory in the Moravian Upper Palaeolithic")

Otte, M., Bonjean, D. & Patou-Mathis, M. 2001, Contractions temporelles au Paléolithique de Sclayn: l'utilisation de différents paysages. In: *Settlement dynamics of the Middle Paleolithic and Middle Stone Age. Volume II* (Conard, N.J., Ed.), Kern Verlag, Tübingen: p. 261-271. (in French) ("Temporal contractions in the Palaeolithic of Sclayn: the use of different landscapes")

Pelegrin, J., Karlin, C. & Bodu, P. 1988, “Chaînes opératoires”: un outil pour le préhistorien. In: *Journée d'études technologiques en Préhistoire* (Tixier, J., Ed.), Notes et Monographies Techniques Vol. 25, Edition du Centre National de la Recherche Scientifique, Paris: p. 55-62. (in French) (““Chaînes opératoires”: a tool for the Prehistorian”)

Pelikán, P. 2010, A Mátra és közvetlen környezetének földtana. In: *A Mátrai Tájvédelmi Körzet. Heves és Nógrád határán* (Baráz, Cs., Ed.), Bükki Nemzeti Park Igazgatóság, Eger: p. 17-26. (in Hungarian) (“Geology of the Mátra and its direct surroundings”)

Péntek, A. 2015, Open-air site complex with leaf-points at Szécsénke (Cserhát Mountains, Northern Hungary). Preliminary results. *Litikum*, 3: 46-69. DOI: https://doi.org/10.23898/litikuma0012

Péntek, A. 2018, Legénd–Hosszú-földek, a new open-air Aurignacian site in the Cserhát Mountains (Northern Hungary). *Archeometriai Műhely*, 15(1): 57-74. URL: http://www.ace.hu/am/2018_1/AM-2018-1-PA.pdf

Péntek, A. & Zandler, K. 2014, Buják-Szente, egy nyílt színi paleolitikus telep. *Litikum*, 2: 5-18. (in Hungarian) (“Buják-Szente, an open-air palaeolithic site”) DOI: https://doi.org/10.23898/litikuma0007

Péntek, A. & Zandler, K. 2017, Chipped stone implements of the Bell Beaker Culture at the settlement and cemetery of Szigetszentmiklós-Felső Ürge-hegyi dűlő. In: *State of the Hungarian Bronze Age research. Proceedings of the conference held between 17th and 18th of December 2014* (Kulcsár, G. & Szabó, G.V., Eds.), Ősrégészeti Tanulmányok / Prehistoric Studies Vol. 2, Institute of Archaeology, Research Centre for the Humanities, Hungarian Academy of Sciences - Institute of Archaeological Sciences, Faculty of Humanities, Eötvös Loránd University - Ősrégészeti Társaság / Prehistoric Society, Budapest: p. 277-307.

Péntek, A. & Zandler, K. 2018, Evidence of Middle Palaeolithic south from Vanyarc (Nógrád County, Northern Hungary). *Dornyay Béla Múzeum Évkönyve*, 41: 220-248.

Pereira, T. & Benedetti, M.M. 2013, A model for raw material management as a response to local and global environmental constraints. *Quaternary International*, 318: 19-32. DOI: https://doi.org/10.1016/j.quaint.2013.04.011

Perlès, C. 1990, L’outillage de pierre taillée néolithique en Grèce: approvisionnement et exploitation des matières premières. *Bulletin de correspondance héllénique*, 114: 1-42. (in French) (“Neolithic knapped stone tool-kit in Greece: raw material supply and exploitation”) URL: https://www.persee.fr/doc/bch_0007-4217_1990_num_114_1_1714

Perlès, C. 2004, *Les industries lithiques taillées de Franchthi (Argolide, Grèce). Tome III: Du Néolithique ancien au Néolithique final*. Excavations at Franchthi Cave fasc. 13. Indiana University Press, Bloomington/Indianapolis. (in French) (“The knapped lithic industry of Franchthi (Argolid, Greece). Vol. III: From the Early Neolithic to the Final Neolithic”)

Perlès, C. 2009, Les industries lithiques néolithiques : logiques techniques et logiques sociales. In: *De Méditerranée et d’ailleurs…Mélanges offerts à Jean Guilaine* (Barbaza, M. *et al.*, Eds.), Archives d’Écologie Préhistorique, Toulouse: p. 557-571. (in French) (“The Neolithic lithic industries: technical logics and social logics”)

Perlès, C. 2013, Tempi of change: When soloists don't play together. Arrhythmia in "continuous" change. *Journal of Archaeological Method and Theory*, 20(2): 281-299. URL: https://www.jstor.org/stable/43654354

Perlès, C. 2016, La technologie lithique, de part et d'autre de l'Atlantique. *Bulletin de la Société préhistorique française*, 113(2): 221-240. (in French) ("The lithic technology on both sides of the Atlantic") URL: https://www.persee.fr/doc/bspf_0249-7638_2016_num_113_2_14622

Pető, A., Kozák, M., Horváth, T. & Kovács-Pálffy, P. 2002, Examination of the stone implements of a Bronze Age earthwork in Hungary. In: *Archaeometry 98, Proceedings of the 31st Symposium, Budapest, April 26-May 3 1998. Vol. II* (Jerem, E. & Biró, K.T., Eds.), BAR International Series Vol. 1043 (II) and Archaeolingua Central European Series Vol. 1, Archaeopress, Oxford: p.783-791.

Petraglia, M., LaPorta, P. & Paddayya, K. 1999, The first Acheulian quarry in India: stone tool manufacture, biface morphology, and behaviors. *Journal of Anthropological Research*, 55(1): 39-70. URL: https://www.jstor.org/stable/3630977

Pinczés, Z., Martonné Erdős, K. & Dobos, A. 1993, Eltérések és hasonlóságok a hegylábfelszínek pleisztocén felszínfejlődésében. *Földrajzi Közlemények*, 117: 149-162. (in Hungarian) ("Differences and similarities in the development of foothills during the Pleistocene")

Přichystal, A. 2010, Classification of lithic raw materials used for prehistoric chipped artefacts in general and siliceous sediments (silicites) in particular: the Czech proposal. *Archeometriai Műhely*, 7(3): 177-181. URL: http://www.ace.hu/am/2010_3/AM-10-03-AP.pdf

Přichystal, A. 2013, *Lithic raw materials in Prehistoric times of Central Europe*. Masaryk University, Brno, 351 p.

Richter, J. 2006, Neanderthals in their landscape. In: *Neanderthals in Europe. Proceedings of the International Conference held in the Gallo-Roman Museum in Tongeren (September 17-19th 2004)* (Demarsin, B. & Otte, M., Eds.), Etudes et Recherches Archéologiques de Université de Liège Vol. 117, Université de Liège, Liège: p. 51-66.

Ringer, Á. & Lengyel, Gy. 2008, The Upper Palaeolithic site at Budapest Corvin-tér. *Praehistoria*, 9-10: 205-211.

Seghedi, I., Downes, H., Harangi, Sz., Mason, P.R.D. & Pécskay, Z. 2005, Geochemical response of magmas to Neogene-Quaternary continental collision in the Carpathian-Pannonian region: A review. *Tectonophysics*, 410: 485-499. DOI: https://doi.org/10.1016/j.tecto.2004.09.015

Sellet, F. 1993, Chaîne opératoire: the concept and its applications. *Lithic Technology*, 18(1-2): 106-112. DOI: https://doi.org/10.1080/01977261.1993.11720900

Simán, K. 1991a, Patterns of raw material use in the Middle Paleolithic of Hungary. In: *Raw material economies among Prehistoric hunter-gatherers* (Montet-White, A. & Holen, S., Eds.), Publications in Anthropology Vol. 19, University of Kansas, Lawrence: p. 49-57.

Simán, K. 1991b, Procurement and distribution of raw materials in the Palaeolithic of North-East Hungary In: *Les bassins du Rhin et du Danube au Paléolithique supérieur : Environnement, habitat et systèmes d'échange* (Montet-White, A., Ed.), Etudes et

Recherches Archéologiques de Université de Liège Vol. 43, Université de Liège, Liège: p. 28-44.

Simán, K. 1995a, H4. The Korlát-Ravaszlyuktető workshop site in North-Eastern Hungary. *Archaeologia Polona*, 33: 41-58.

Simán, K. 1995b, H1. Prehistoric mine on the Avas Hill at Miskolc. *Archaeologia Polona*, 33: 371-382.

Starnini, E. & Szakmány, Gy. 1998, The lithic industry of the Neolithic sites of Szarvas and Endrőd (South-eastern Hungary): Techno-typological and archaeometrical aspects. *Acta Archaeologica Academiae Scientiarum Hungaricae*, 50: 279-342. URL: http://real-j.mtak.hu/228/1/ACTAARCHEOLOGICA_50.pdf

Starnini, E., Voytek, B.A. & Horváth, F. 2007, Preliminary results of the multidisciplinary study of the chipped stone assemblage from the Tisza culture site of tell Gorzsa (Hungary). In: *The Lengyel, Polgár and related cultures in the Middle/Late Neolithic in Central Europe* (Kozłowski, J.K. & Raczky, P., Eds.), The Polish Academy of Arts and Sciences Kraków-Eötvös Loránd University Institute of Archaeological Sciences Budapest, Kraków: p. 269-278.

Sudoł-Procyk, M., Budziszewski, J., Krajcarz, M.T., Jakubczak, M. & Szubski, M. 2018, The chocolate flint mines in the Udorka valley (Częstochowa Upland) - a preliminary report on the field and Lidar surveys. In: *Between history and archaeology: Papers in honour of Jacek Lech* (Werra, D.H. & Woźny, M., Eds.), Archaeopress, Oxford: p. 89-102. URL: https://rcin.org.pl/Content/130348/WA308_99795_Chocolate-Flint-Mines_I.pdf

Szakmány, Gy., Starnini, E., Horváth, F. & Bradák, B. 2011, Investigating trade and exchange patterns in Prehistory: Preliminary results of the archaeometric analyses of stone artefacts from tell Gorzsa (South-East Hungary). In: *Proceedings of the 37th International Symposium on Archaeometry 12th - 16th May 2008, Siena, Italy* (Turbanti-Memmi, I., Ed.), Springer-Verlag, Berlin-Heidelberg: p. 311-319.

Stout, D. 2002, Skill and cognition in stone tool production: An ethnographic case study from Irian Jaya. *Current Anthropology*, 43(5): 693-722. DOI: https://doi.org/10.1086/342638

Szekszárdi, A., Szakmány, Gy. & Biró, K.T. 2010, Tokaji-hegységi limnokvarcit-limnoopalit nyersanyagok és pattintott kőeszközök archeometriai vizsgálata. I.: Földtani viszonyok, petrográfia. *Archeometriai Műhely*, 7(1): 1-17. (in Hungarian) ("Archaeometric analysis on limnic-quartzite limnic opalite raw materials and chipped stone tools, Tokaj Mts. NE-Hungary. I.: geological settings, petrography") URL: http://www.ace.hu/am/2010_1/AM-10-01-SZA.pdf

Texier, P.-J. & Meignen, L. 2012, Soixante années de technologie lithique : étapes marquantes, apports et écueils. In: *François Bordes et la Préhistoire* (Delpech, F. & Jaubert, J., Eds.), Documents préhistoriques Vol. 29, Editions du Comité des Travaux Historiques et Scientifiques, Paris: p. 133-139. (in French) ("Sixty years of lithic technology: outstanding stages, contribution and pitfalls")

Tixier, J. 1980, Préhistoire, la taille expérimentale des roches dures. In: *Encyclopedia Universalis* Vol. 13, Paris: p. 1199-1201. (in French) ("Prehistory, experimental knapping of hard rocks")

Tixier, J. 2012, *A method for the study of stone tools. Méthodes pour l'étude des outillages lithiques*. ArchéoLogiques Vol. 4, Centre National de Recherche Archéologique-Musée National d'Histoire et d'Art, Luxembourg, 195 p.

Tóth, Z.H. 2016, Palaeolithic heat treating in Northeastern Hungary? An archaeometric examination of the possible use of fire-setting in Stone Age quarries in the Bükk area. *Archaeologia Polona*, 54: 129-135. URL: https://rcin.org.pl/publication/83016

Turq, A. 1996, L'approvisionnement en matières premières lithiques au Moustérien: quelques observations et réflexions. In: *Néandertal* (Bonjean, D., Ed.), ASBL Archéologie Andennaise, Andenne: p. 168-179. (in French) ("Lithic raw material supply in the Mousterian: some observations and reflections")

Turq, A. 2000, *Le Paléolithique inférieur et moyen entre Dordogne et Lot*. Paléo - Supplément Vol. 2, Société des Amis du Musée national de Préhistoire et de la Recherche Archéologique, Les Eyzies, 456 p. (in French) ("The Lower and Middle Palaeolithic between Dordogne and Lot")

Turq, A. 2005, Réflexions méthodologiques sur les études de matières premières lithiques. *Paléo*, 17: 111-132. (in French) ("Methodological reflections on the study of lithic raw materials") DOI: https://doi.org/10.4000/paleo.883

Varga, Gy., Csillagné Teplánszky, E. & Félegyházi, Zs. 1975, A Mátra hegység földtana. *Magyar Állami Földtani Intézet Évkönyve*, 57(1): 1-575. (in Hungarian) ("Geology of the Mátra Mountains") URL: http://epa.oszk.hu/03200/03274/00028/pdf/EPA03274_mafi_evkonyv_1975_009-480.pdf

Vendl, A. 1940, Das Gesteinsmaterial der Paläolithe. In: *Die Mussolini-Höhle (Subalyuk) bei Cserépfalu* (Bartucz, L., Dancza, J., Hollendonner, F., Kadić, O., Mottl, M., Pataki, V., Pálosi, E., Szabó, J. & Vendl, A., Eds.), Geologica Hungarica Series Palaeontologica Vol. 14, Editio Instituti Regii Hungarici Geologici, Budapest: p. 169-199. (in German) ("Stone material of the palaeolithic artefacts")

Vermeersch, P.M. 2005, Middle Palaeolithic chert extraction structures in Egypt. *Praehistoria*, 6: 57-69.

Vértes, L. & Tóth, L. 1963, Der Gebrauch des glasigen Quarzporphyrs im Paläolithikum des Bükk-Gebirges. *Acta Archaeologica Academiae Scientiarum Hungaricae*, 15: 3-10. (in German) ("The use of the vitreous quartz-porphyry in the Palaeolithic of the Bükk Mountains")

Vörös, I. 1998-1999, Antlers from the Prehistoric flint mine at Denevér street (Budapest - Farkasrét). *Folia Archaeologica*, 47: 69-102.

Wein, Gy. 1977, *A Budai hegység tektonikája*. Magyar Állami Földtani Intézet, Budapest, 76p. (in Hungarian) ("Tectonics of the Buda Mountains")

Weisgerber, G., Slotta, R. & Weiner, J. (Eds.) 1981, *5000 Jahre Feuersteinbergbau. Die Suche nach dem Stahl der Steinzeit*, Veröffentlichungen aus dem Deutschen Bergbau-Museum Bochum Vol. 22, Deutsches Bergbau-Museum Bochum, Bochum, 672 p. (in German) ("5000 years of flint mining. The search for the steel of the Stone Age")

Whallon, R. 2006, Social networks and information: non-"utilitarian" mobility among hunter-gatherers. *Journal of Anthropological Archaeology*, 25: 259-270. DOI: https://doi.org/10.1016/j.jaa.2005.11.004

Zandler, K. 2010, Paleolit telep Hont-Csitáron. In: *Régről kell kezdenünk…" Studia Archaeologica in honorem Pauli Patay. Régészeti tanulmányok Nógrád megyéből Patay Pál tiszteletére* (Guba, Sz. & Tankó, K., Eds.), Gaál István Egyesület, Szécsény: p. 23-49. (in Hungarian) ("Palaeolithic settlement at Hont-Csitár")

Zelenka, T. 2010, A Mátra hegység paleogén és neogén vulkanizmusa. In: *A Mátrai Tájvédelmi Körzet. Heves és Nógrád határán* (Baráz, Cs., Ed.), Bükki Nemzeti Park Igazgatóság, Eger: p. 27-38. (in Hungarian) ("Palaeogene and Neogene volcanism of the Mátra Mountains")

De la roche-mère à l'alluvium : Considérations sur l'interaction entre les humains et les sources de matière première

Zsolt Mester[1,2], Norbert Faragó[1]

1. Institut des Sciences Archéologiques, Université Eötvös Loránd, Múzeum krt. 4/B, 1088 Budapest, Hongrie.
Email: Z. Mester: mester.zsolt@btk.elte.hu, N. Faragó: farago.norbert@btk.elte.hu
2. UMR 7194 Histoire Naturelle de l'Homme Préhistorique, CNRS/MNHN/UPVD, Institut de Paléontologie humaine, 1 Rue René Panhard, 75013 Paris, France

Résumé:

Bien que les investigations sur les origines des matières premières lithiques en Hongrie aient commencé à la fin des années 1970, y compris les fouilles de mines préhistoriques, peu d'attention a été faite à l'aspect anthropologique : comment des hommes préhistoriques ont acquéris les matières premières pour leur production lithique. L'approche palethnologique que nous appliquons dans cette recherche vise à reconstituer la vie d'un groupe humain préhistorique, c'est-à-dire d'étudier leur relation au monde environnant. Autrement dit, de reconnaître les éléments de l'environnement qui ont jouer un rôle dans leur stratégies de survivre, y compris l'économie de matières premières et la production d'outils. Du point de vue anthropologique, l'acquisition et l'utilisation préhistoriques des matières premières sont influencées par une game de différents facteurs. Ces facteurs ont été mesurés par les hommes préhistoriques pour envisager la potentialité de gîtes comme sources de matière première. Le modèle *Occurrence-Source-Archaeological site* (OSA) que nous présentons dans cet article aide de décrire l'interaction des ressources de roches siliceuses et des humains. Tous les lieux où se trouvent des roches aptes à la taille sont considérés une *Occurrence*. Si la matière première lithique de cette occurrence se rencontre dans les matériels archéologiques, nous l'appelons une *Source* parce qu'elle a été utilisée par les humains. Tous les lieux où se trouvent des vestiges des activités humaines sont considérés un *Archaeological site*. Avant l'effet humain, les gîtes de roches siliceuses considérés comme sources de matière première ont eu leur propre histoire, de la roche-mère originale aux dépôts alluviaux, due aux processus géologiques-géomorphologiques de formation, de transformation et de transport. D'après Alain Turq, les sources de matière première peuvent être regroupées dans quatre catégories principales : sources autochtones primaire et secondaire, sources sub-allochtone et allochtone. Le type de la source a un effet non seulement sur la distance de transport mais également sur la qualité des blocs procurés, et il fournit de conditions différentes d'acquisition de blocs de matière première. Sur la base de ces considérations, notre recherche a deux objectifs : de localiser les resources naturelles lithiques potentielles dont pouvaient disposer les hommes préhistoriques vécus dans la région dans une période donnée, ainsi que de comprendre le choix humain effectué entre ces resources avec son arrière-plan comportemental. Pour le premier objectif, toutes sortes d'affleurements de roches siliceuses de la région ont été cartographiées. Pour le second objectif, une analyse techno-économique est appliquée. Nous avons étudié deux aires en Hongrie du nord : la région de piémont de Mátraalja et la partie méridionale des monts de Buda. Tous les deux aires ont une longue histoire géologique dans la formation animée des Carpates et du bassin Pannonien. Tous les deux disposent d'un type caractéristique de matière première locale : les limnosilicites dans la montagne de Mátra et la chaille de Buda dans les monts de Buda. L'utilisation de ces matières premières spécifiques est documentée aux sites archéologiques pour plusieurs périodes de la Préhistoire. Tous les deux matériaux ont plusieurs gîtes dans les aires étudiés qui pouvaient être considérés comme sources par différents groupes humains ou communautés préhistoriques vivant là. Selon les catégories de Turq, le type allochton de source ne s'y trouve pas, mais les types autochtons primaire et secondaire ainsi que le type sub-allochton ont été identifiés dans tous les deux aires. Cependant, l'exploitation des sources autochtones primaires de limnosilicite ne peut pas être prouvée dans la région de Mátraalja. Pour le moment, l'exploitation des sources autochtones secondaires et celle des sources sub-allochtones semblent les plus vraisemblables pour toutes les périodes concernées.

Mots-clés: gîtes des roches siliceuses: sources de matière première; modèle OSA de l'interaction, Paléolithique, Néolithique, Hongrie du nord